

ABSTRACT

Title of Dissertation: OBSERVED SOCIAL PROBLEM SOLVING
AND FRIENDSHIP QUALITY IN CHILDREN
WITH A TRAUMATIC BRAIN INJURY

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Children who have experienced a traumatic brain injury (TBI) are at risk for a variety of maladaptive cognitive, behavioral and social outcomes (Yeates et al., 2007). Research involving the social problem solving (SPS) abilities of children with TBI indicates a preference for lower level strategies when compared to children who have experienced an orthopedic injury (OI; Hanten et al., 2008, 2011). Research on SPS in non-injured populations has highlighted the significance of the identity of the social partner (Rubin et al., 2006). Within the pediatric TBI literature few studies have utilized friends as the social partner in SPS contexts, and fewer have used in-vivo SPS assessments. The current study aimed to build on existing research of SPS in children with TBI by utilizing an observational coding scheme to capture in-vivo problem solving behaviors between children with TBI and a best friend.

The current study included children with TBI ($n = 41$), children with OI ($n = 43$), and a non-injured typically developing group ($n = 41$). All participants were observed completing a task with a friend and completed a measure of friendship quality. SPS was assessed using an observational coding scheme that captured SPS goals, strategies, and outcomes. It was expected children with TBI would produce fewer successes, fewer direct strategies, and more avoidant strategies. ANOVAs tested for group differences in SPS successes, direct strategies and avoidant

strategies. Analyses were run to see if positive or negative friendship quality moderated the relation between group type and SPS behaviors.

Group differences were found between the TBI and non-injured group in the SPS direct strategy of commands. No group differences were found for other SPS outcome variables of interest. Moderation analyses partially supported study hypotheses regarding the effect of friendship quality as a moderator variable. Additional analyses examined SPS goal-strategy sequencing and grouped SPS goals into high cost and low cost categories. Results showed a trend supporting the hypothesis that children with TBI had fewer SPS successes, especially with high cost goals, compared to the other two groups. Findings were discussed highlighting the moderation results involving children with severe TBI.

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CHILDREN WITH A TRAUMATIC BRAIN INJURY

by

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2016

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Acknowledgements

First and foremost I would like to thank my advisor, Ken Rubin, for his mentorship over these past 5 years. With Ken's mentorship I have been able to develop as an independent researcher and specialize my interests related to social competence, social problem solving, and peer relationships. Ken's role as a SOBIK collaborator allowed me to explore my research interests as they relate to children with TBI. I am thankful for being part of the SOBIK project and for having the opportunity to work with all of the other co-investigators. Additionally, Ken's expertise with observational coding has helped me greatly as I worked through my dissertation study.

I am grateful for the support of my committee members, Drs. Andrea Chronis-Tuscano, Melanie Killen, Geetha Ramani, and Keith Yeates. Each took the time to offer constructive feedback for my proposal document. I thank them for giving their time to read my documents and to sit in on my proposal and defense. I look forward to my upcoming defense and hearing your suggestions on how to make my dissertation a stronger study.

I must acknowledge all of my friends for their continued support throughout my time at the University of Maryland. The HDQM graduate students are a fun, special bunch who I am grateful to call my friends and colleagues. If anything I am glad to have spent my time with a group that reinforces the idea work can be fun if you are lucky enough to have such great colleagues. I thank all of my non-school friends for their encouragement and for providing much needed "no school" time.

The support of my fellow Rubinlabers has been instrumental. I'd like to specifically acknowledge my friend Dr. Maureen Wimsatt for being the best "partner in research crime" a person could ask for. I would also like to thank fellow Philadelphian and officemate Matt Barstead for indulging me in my most stressful moments and for helping to keep levity in the lab.

Last, but most certainly not least, I must thank my parents for their unwavering support. My achievements are largely a reflection of the persistence and resilience I have witnessed each of them exhibit. I look up to and thank them for working as hard as they did so I could have a graduate career and be in the position of defending this dissertation. This dissertation is for you guys.

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Chapter 1: Introduction

I. Definition and Theory

Social problem solving (SPS) refers to the ability to *effectively* attain a personal goal within a dyadic or group context (D’Zurilla, Nezu, & Maydeu-Olivares, 2004; Rose-Krasnor & Rubin, 1983). Effectively attaining a personal goal requires cognitive flexibility in strategy production and selection, perspective taking, and appropriate evaluation of social consequences of potential outcome(s) (Rose-Krasnor & Rubin, 1983). SPS skills underlie the larger construct of social competence, and are critical for successful interaction with others.

The proposed study is rooted in Hinde’s (1976; 1987) theoretical framework of interactions and relationships, which highlighted various influential factors related to the individual, dyad, or group. Hinde (1976) stressed the importance of taking into account factors related to the individual, such as temperament and gender, when describing and classifying interpersonal relationships. The current study examined the influence of an *individual’s* physical injury status on overarching SPS behaviors. At the dyadic level, the nature of the *relationship* between both social partners adds another source of complexity, as unknown peers will interact differently than dyadic partners who are friends. Further, the *quality* of the relationship is of paramount importance (Hinde, 1976). In other words, it has been proposed that the interactions between dyadic partners who have a positive relationship will vary from interactions between partners whose relationships are more negatively disposed. The current study focused on best friend dyads and explored how the quality of friendship relates to the demonstration of SPS during social interaction.

Early theoretical work on SPS stemmed from the cognitive literature that focused on problem solving (D’Zurilla & Goldfried, 1971). Key concepts were operationalized, such as “problem”, “problem situation”, and “solution”; these helped inform early components of subsequent models of SPS (D’Zurilla & Goldfried, 1971). Subsequent models of SPS built upon the problem solving literature by taking into account other factors which may influence SPS situations, such as who the social partners are, the history of the social partners, and the emotional and cognitive maturity of each social partner (Dodge, 1986; Rubin & Rose-Krasnor, 1986; Selman, 1980; Spivack & Shure, 1974).

II. Assessment

SPS has largely been assessed via either Likert-style questionnaires or hypothetical situation interviews (D’Zurilla, Nezu, & Maydeu-Olivares, 2004; Rubin & Rose-Krasnor, 1992; Yeates, Schultz, & Selman, 1991). Few studies have utilized observational methodology in order to capture SPS. Observational methodologies, while labor intensive, offer a comprehensive window into an individual’s ability to solve interpersonal dilemmas as they occur in live time. Two previous studies used the original format of the observational SPS coding scheme that was adapted for this dissertation (Rose-Krasnor & Rubin, 1983; Stewart & Rubin, 1995). In both of these previous studies, the observational coding scheme was used with preschool and elementary school-aged children in a play setting. For the purposes of this dissertation the observational coding scheme has been adapted, because a pre-set SPS task was involved and participants were largely of middle childhood age. Also divergent from

the previous studies, the SPS task used for the current study involved two best friends working together to problem solve, as opposed to a larger peer group.

III. Friendship and Social Problem Solving

The current study included a friendship component that has few exemplars in the existing SPS literature. Friendship offers increased opportunities for social skill practice, while providing a safe context for disagreement and conflict (Laursen, 1996; Laursen & Pursell, 2009). Additionally, friends are more sensitive to each other's opinions and needs, since the risk of losing a friendship carries more weight than creating conflict with a non-friend peer. What is less clear is how friendship characteristics, such as friendship quality, impact a dyad's SPS. The exact associations between friendships characterized as highly positive or highly negative and specific SPS skills are not well documented. When considering highly positive friendships and friendships characterized by negativity, it is not entirely clear which SPS strategies may be more common for each or how often SPS successes versus failures occur. These are some of the questions explored in the current study.

IV. Social Problem Solving, Friendship, and Children with Traumatic Brain Injury (TBI)

Injury to certain brain substrates has been found to influence cognitive and affective variables that underlie social behaviors of children (Yeates et al., 2012). For example, injury to the frontotemporal and limbic regions has been found to affect self-regulatory behaviors, emotional processing, executive functions, and processes related to theory of mind (Yeates et al., 2012). For children who have experienced a traumatic brain injury (TBI), their injuries may extend to influence the

display of SPS behaviors (Hanten et al., 2008; Janusz et al., 2002). Compared to age-matched and sex-matched peers who have experienced an orthopedic injury (OI), children with TBI have been found to generate lower-level SPS strategies, specifically strategies that are more impulsive, avoidant, and egocentric (Hanten et al., 2008; Janusz et al., 2002, Moran et al., 2015). Significantly, the data upon which these findings emanate largely utilized measures of SPS that comprised hypothetical scenarios, and no known studies have utilized observational methodology in order to capture SPS behaviors and their consequences.

An understanding of how friendship and friendship quality influence SPS of children with TBI is also lacking. Research on the friendships of children with TBI is sparse, but suggests that the presence and quality of close friendships do not differ from the friendships of non-injured children (Bohnert, Parker, & Warschausky, 1997; Heverly-Fitt et al., 2014). Some children with TBI do report having best friends, and the quality of those friendships has been characterized as positive and satisfactory (Heverly-Fitt et al., 2014). What remains unclear is how positive or negative friendship characteristics influence in-vivo SPS behaviors. It may be the case that problem solving within a friendship context, especially one where the relationship is viewed as positive, has an influence on the maturity and proficiency of SPS behaviors. Many empirical questions are raised here: Can SPS be coded observationally in children with TBI? Are SPS behaviors of children with TBI, when coded observationally within a best friend context, different when compared to a typical, non-injured population? And, what effect, if any, does friendship quality have on the SPS behaviors of children with TBI?

V. Specific Aims

In order to address these research gaps, observed SPS and the friendship quality of best friend dyads for three separate groups were examined. These three groups include: children with TBI, children with OI, and typically developing, non-injured children. This dissertation had three specific aims. Each aim is discussed in more detail at the end of Chapter Two.

The first aim of this study was to utilize an adapted observational coding scheme of social problem solving goals, strategies, and outcomes with best friend dyads.

The second aim of this study was to explore potential group differences in observable SPS behaviors amongst children with TBI, children with OI, and typically developing non-injured children.

The third aim of this study was to examine the potential moderating effect of friendship quality on the association between group type (TBI, OI, or typically developing non-injured) and SPS.

Chapter 2: Literature Review

For the purposes of the current study, SPS is defined as the ability to *effectively* attain a personal goal within a dyadic or group context (D’Zurilla, Nezu, & Maydeu-Olivares, 2004; Rose-Krasnor & Rubin, 1983). Effectiveness refers to the capacity for cognitive flexibility in strategy production and selection, perspective taking, and appropriate evaluation of social consequences of potential outcome(s) (Rose-Krasnor & Rubin, 1983). The purposes of this review were to outline how SPS has been defined and assessed, and to draw from the existing research to address the significance of the lack of observational methodologies in the study of interpersonal problem solving. Since SPS occurs, at the very least, within a dyadic context, attention will then be focused on literature that integrates how SPS abilities are related to friendship and friendship quality. Lastly, an argument will be made for applying a novel observational methodology for assessing SPS within friend dyads to a clinical population at risk for socio-cognitive dysfunction (Taylor et al., 2002; Yeates et al., 2002; Yeates et al., 2007).

First, a conceptualization of different levels of interpersonal interactions will be explored. Models related to SPS will then be outlined, as well as a discussion of the various means of assessment for SPS. Specific attention will be drawn to the lack of observational methodology used in the study of SPS. Next, literature will be presented that focuses on the contextual influence of friendship on SPS. Discussion will then shift to how these models and assessments of SPS have been used in a clinical population of children who have experienced a traumatic brain injury (TBI). The current surge in research focusing on social outcomes of children with TBI is

lacking in a comprehensive understanding of their SPS capabilities, especially how these capabilities are influenced when interacting with a friend. This lack of a comprehensive understanding is further compounded by the fact that observational assessments of SPS are virtually non-existent within this specific clinical population.

I. Background Theoretical Framework

The following discussion related to SPS is heavily influenced by the theoretical framework of Hinde (1976; 1987) and his model of relationships. Since SPS occurs during interactions with others, it is necessary to take into account the significance of interpersonal interactions and relationships. These interactions can be dissected into components relating to the individual, the dyad, and the peer group (Hinde, 1976). The child brings numerous individual characteristics into social interactions, such as temperament, gender, and race (Hinde, 1976; Stevenson-Hinde, & Hinde, 2011). In addition to these basic demographic and biological characteristics, other individual characteristics such as intelligence, physical injury status, or medical disability/illness may also influence psycho-social functioning (Hinde, 1976; Hinde & Stevenson-Hinde, 1976).

All of the aforementioned individual characteristics influence dyadic interactions with peers, parents, siblings, coaches, and teachers. The nature of dyadic interactions becomes even more complex, as one must consider dimensions related to quality, frequency, reciprocity/complementarity, diversity, and cognitive and moral levels of the participants (Hinde, 1976). In terms of quality, interactions can be positive, negative, supportive, contentious, and so on. All of these qualities can vary depending on whether the individual is interacting with a friend, acquaintance,

unfamiliar peer, or authority figure (e.g. teacher, parent; Dunn, Cutting, & Fisher, 2002; Hinde, 1976; McDonald, Putallaz, Grimes, Kupersmidt, & Coie, 2007; Rubin, Oh, Menzer, & Ellison, 2011). The relative frequency of interactions is self-explanatory, but the patterning of these interactions is also important. For example, a child may have very few interactions with a peer throughout the school year, but those interactions may always involve rejection by the peer. Both the frequency and the patterning of such interactions will greatly contribute to the overall quality of that dyadic relationship (Hinde, 1976).

Reciprocity refers to interpersonal interactions in which both participants show similar behaviors, whether it be simultaneously or alternatively (Hinde, 1976). For example, children who are shy/withdrawn tend to befriend others who are similarly shy/withdrawn (Rubin, Wojslawowicz, Rose-Krasnor, Booth-LaForce, & Burgess 2006). *Complementary* interactions involve participants who exhibit behaviors that are different, but complement one another. Within a friendship one individual could be more reserved while the other more outgoing. The contrasting behaviors in such a situation complement one another. The diversity of a social interaction can be uniplex or multiplex (Hinde, 1976). *Uniplex* refers to situations in which a dyad commonly involves one type of interaction, such as two children who only interact in youth soccer. *Multiplex* refers to interactions characterized by diversity. An example of a relationship characterized by multiplex interactions would be two children who interact with each other at school, on the playground, after school at baseball practice, and on the weekend at each other's houses. With

multiplex interactions individuals demonstrate different facets of their personality and have more opportunity for shared experiences (Hinde, 1976; Hinde, 1987).

The cognitive capabilities and moral reasoning of participants are of critical importance to the nature and stability of any dyadic interaction (Hinde, 1976; Hinde, 1987). As will be discussed in further detail, deficits in any process related to cognition can influence how an individual perceives and reacts during a social encounter. Relatedly, differences in the moral sense of obligation can influence interactions. For example, a child witnessing a peer steal an item from another classmate may adjust their perceptions of the deviant peer as well as their desirability to interact with that peer in the future. Discrepancies in the cognitive capabilities and moral levels of two individuals can greatly influence the overall nature of dyadic interactions (Hinde, 1976; Hinde, 1987).

Lastly, *groups* involve the greatest complexity in terms of social interaction (Hinde, 1976; Hinde, 1987). The composition of a group can be based on shared interests or activities, or can be due to situational circumstances (e.g. a peer group in school; Hinde, 1976; Kindermann, 2007; Rubin, Bukowski, & Parker, 2015). Group characteristics can differ on a multitude of factors, including cohesiveness, heterogeneity, and the accepted pattern of norm-related attitudes and behaviors that serve to distinguish one group from another (e.g. Philadelphia sports fans).

Through Hinde's (1976; 1987) theoretical framework, it is evident that the combined influences of individual characteristics, social interactions, and the nature of dyadic and group relationships aid in molding our thoughts, perceptions, behaviors, and ensuing competencies during social encounters. As noted below in the description

of relevant SPS models, how effectively and adeptly these thoughts, perceptions, and behaviors are manifested and acted upon will greatly impact an individual's SPS abilities.

II. Defining Social Problem Solving

Early work on problem solving focused on defining basic terms such as *problem*, *problem situation*, and *solution* (D'Zurilla & Goldfried, 1971). *Problem* refers to "a specific situation or set of related situations" that a person must respond to in order to function effectively within his or her environment. *Problem situation* refers to a context where "no effective response alternative is immediately available to the individual confronted with the situation" (Davis, 1966; D'Zurilla & Goldfried, 1971). *Solution* has been defined as a response that alters the situation such that it is no longer problematic, and simultaneously maximizes positive consequences while minimizing negative consequences (D'Zurilla & Goldfried, 1971). Taken together, scholars have used the aforementioned terms to define *problem solving* as an overt or cognitive behavioral process that creates "a variety of potentially effective response alternatives, and increases the likelihood of choosing the most effective response among the available alternatives" (D'Zurilla & Goldfried, 1971; D'Zurilla & Maydeu-Olivares, 1995).

Such early conceptualizations of problem solving are quite broad and can be applied to many contexts including the interpersonal (e.g., conflict with a family member or a friend), intrapersonal (e.g., emotional or behavioral problems), or the impersonal (e.g., delays in transportation; D'Zurilla, Nezu, & Maydeu-Olivares, 2004). The primary focus of this study was on the interpersonal context of SPS. There

are numerous components that contribute to the cognitive, emotional, and behavioral processes involved in SPS. Various models of SPS have been proposed that conceptualize the integration of these components.

III. Models of Social Problem Solving

Different models have been proposed in an effort to identify the underlying cognitive processes involved during SPS (Dodge; 1986; Rubin & Rose-Krasnor, 1986; Spivack & Shure, 1974; Selman, 1980). These models build upon the more strict cognitive models of problem solving by incorporating an interpersonal component. Goldfried and D’Zurilla (1969) proposed one such model that focuses solely on the cognitive and behavioral processes undertaken once a problem has been identified. The authors (1969) outlined the following steps that occur during problem solving: a) identification of the problem; b) generating a variety of strategies; c) choosing one of the generated strategies; d) strategy implementation. This model of problem solving proved useful by identifying a step-by-step process of the decision making involved in problem solving. However, the model lacks any inclusion of how each of these steps may be influenced within an interpersonal context.

Spivack and Shure’s Interpersonal Cognitive Problem Solving Skills

Spivack and Shure (1974) expanded on Goldfried and D’Zurilla’s (1969) problem solving framework by emphasizing the importance and influence of interpersonal dynamics. Spivack and Shure’s (1974) model was designed to help socially maladjusted children via a focus on the development of problem-solving skills and the social contexts within which they occur. They outlined a step-by-step

process involved in what they defined as interpersonal cognitive problem solving skills (ICPS).

The ICPS skills include: a) sensitivity to, or recognition of, a problem; b) the ability to generate alternative solutions to the problem (alternative solution thinking); c) the ability to consider the step-by-step means required to achieve social goals (means-end thinking); d) the ability to foresee consequences of social acts for all those involved (weighing pros and cons), and to generate alternative consequences to social acts prior to deciding how to behave (consequential thinking); and e) the ability to identify and understand the motives and behavior of others. Spivack and Shure's (1974) ICPS model is useful in the context of SPS because it acknowledges the need to perspective take and consider the consequences of one's social behavior.

Rubin and Rose-Krasnor's Social Information Processing Model of Social Competence

Rubin and Rose-Krasnor (1986; 1992) developed a model of social competence based in a social information processing framework. The model was based on a set of assumptions, one being that social interchanges reflect automaticity in thinking. This refers to the notion that initiations and responses to social greetings or other common social cues become part of an automatic script that drives behavior. Due to their limited social experiences, children often find themselves faced with novel situations, or situations where their expectations are violated. In these cases, automaticity in thinking may not occur or prove adaptive.

Rubin and Rose-Krasnor (1986) also highlighted the importance of context during social interactions. For example, is the child interacting with a friend, an

unknown peer, or an adult? Further, where the social interaction is occurring matters. For example, are the social partners interacting on neutral ground (e.g. a playground) or at one of the children's homes? Whether or not the interaction is happening in private or in public is likely to influence a child's behavior.

The model (Rubin & Rose-Krasnor, 1986) incorporated the following components in order to explain how children navigate complex social situations: selection of a social goal; examination of the task environment; accessing and selecting a strategy, strategy implementation, and assessment of strategy outcome.

The *selection of a social goal* refers to the desired end state for a problem situation. Examples of social goals include: initiating play, receiving help, acquiring an object, or information acquisition. Goals may require flexibility and may change during the problem solving process, and it is the primary operating social goal that informs outcome feedback (Rubin & Rose-Krasnor, 1986).

Examination of the task environment refers to the aforementioned contextual factors that influence SPS. Factors can include the age or gender of the protagonist and target of the social goal; the relative social status of the participants (e.g., dominance status, popularity); familiarity of the social partners; behavioral reputation (e.g., status as a bully); and type of relationship (e.g., acquaintance, best friends, unfamiliar other; siblings). For example, as early as the preschool years, children have been observed to alter their goals, targets, and strategies depending on the characteristics of the protagonist and the social target (e.g., Krasnor & Rubin, 1983).

Rubin and Rose-Krasnor's (1986) model goes on to specify that when accessing a strategy, children search their pre-existing cognitive database for tactics

that they believe would allow successful achievement of a given social goal. One or multiple strategies may be considered based on an intrapersonal estimation of the likelihood of meeting a successful outcome. For example, if a child's goal is to obtain a toy another peer is playing with, one strategy could be to grab the toy; another, more competent strategy, could be to ask to share the toy.

Once a specific strategy is selected, it can be retrieved and implemented in the relevant context. The *strategy outcome* requires a child to appropriately infer whether or not the strategy of choice was effective. Social goals deemed to be effective conclude the problem solving process. It is also possible for a social goal to be partially effective. Choosing to take a toy from another child, while achieving a social goal, may not be entirely effective in terms of avoiding negative consequences (e.g. retribution, negative perceptions of the protagonist). Partially effective social goals become assessed as either being successful enough, thus ending the social problem process, or assessed as a failed strategy (Rubin & Rose-Krasnor, 1986).

Failed strategies can result in three different outcomes. A child facing a failed strategy may choose to give up on the initial social goal entirely. Another possible outcome is for a child to re-assess the social goal and implement a new or slightly modified strategy. Lastly, a third potential outcome is that the original strategy could be repeated.

Less competent problem solvers attempt to repeat previously failed strategies. This could be due to a failure in accurately assessing the task environment following implementation of a strategy, having limited alternative means to problem solve, or due to an inability to store the knowledge of the failed strategy. Competent social

problem solvers tend to be more adaptable, and better readers of the task environment (Krasnor & Rubin, 1981; Warden & MacKinnon, 2003).

Dodge's Model of Social Information Processing

Dodge (1986) used a similar model of social information processing in order to better understand the social cognitive processing of children who display *aggressive* behaviors. Dodge (1986) proposed five cognitive steps that occur during social encounters. The first step is the encoding of cues. Social cues can include the familiarity of the other person (e.g. friend, teacher, stranger); the context of the interaction (e.g. school, friend's backyard); as well as other relevant information such as the disposition of the other person (e.g. angry, friendly). Encoding is also influenced by a database of knowledge, which includes acquired rules and social schemas. This is not unlike the step of examining the task environment in the Rubin and Rose-Krasnor (1986) model.

The second step in the model is the interpretation of the encoded cues. Whether or not the encoded cues are correctly or incorrectly assessed has implications for the subsequent steps. For example, a child who perceives their partner to be angry or combative will generate different potential responses in contrast to those that would be generated if the partner were perceived as bored or playful.

The third step involves generating and accessing strategies. If the child's social partner is perceived to be angry, that will generate a specific set of strategies. The fourth step involves evaluating each of the accessed strategies. Considerations when evaluating strategies may revolve around whether or not the desired outcome

will be achieved or if the social partner will react negatively or positively. The fifth step involves behaviorally enacting the chosen strategy.

Crick and Dodge (1994) later reformulated the original model and made it more integrative at each step of processing. Whereas Dodge's 1986 model was more linearly step-based in its conceptualization, the Crick and Dodge 1994 model displayed a more integrative cycle of processing. The database in the 1994 model was conceptualized to inform each processing step, as opposed to solely influencing the encoding stage. An additional step of clarification of goals was added between interpreting cues and generating responses. Lastly, the reformulated model included a component of peer evaluation and peer response to the target child's behavior enactment.

The steps of Crick and Dodge's (1994) social information processing model are largely based on cognitive processes, and researchers have since integrated emotional processes into the model. For example, Lemerise and Arsenio (2000) proposed an integrative model that acknowledged the affective nature of one's relationships with their peers. This model also takes into account child emotion regulation, mood, and temperament (Lemerise & Arsenio, 2000). The model suggests that the strength of the relationships children have with peers can influence their emotional and empathetic responses.

Selman's Model of Interpersonal Negotiation Strategies

Selman's (1980) Interpersonal Negotiation Strategies (INS) model is based in the larger context of social perspective taking. The INS model was influenced by Piaget's (1932; 1964) structural developmental theory, Mead's (1934) self-other

concept, Werner's (1948) ontogenetic approach, and Kohlberg's (1969) moral dilemma paradigms.

Importantly, Selman and colleagues (Selman & Schultz, 1989; Selman, Schorin, Stone, & Phelps, 1983) framed their model within the context of two required criteria: an *ongoing relationship* that is experiencing *disequilibrium*. Drawing from Hinde's (1976) work, interpersonal negotiations between individuals with a personal history will always be more complex than those between unknown individuals. The psychological and affective aspects of ongoing relationships greatly inform the observable social behaviors that individuals display. Those in an ongoing relationship have more consideration for outcomes that are mutually desirable and do not threaten the longevity of the relationship (Selman, 1980; Selman & Schultz, 1989).

The second required criterion for the INS model is that the relationship is undergoing disequilibrium. The disequilibrium is observed behaviorally, but the internal disequilibrium of each individual can be inferred (Selman & Schultz, 1989). For example: Don reaches to grab a doll that Betty is playing with; and Betty holds onto the doll while saying: "I'm not done playing, you can have it when I'm done". Don continues to reach for the doll and replies, "You've had the doll for a while now I want a chance to play with it".

The behavioral disequilibrium is observable via the tugging on the desired object (the doll). Internal disequilibrium is evident in both social partners. Don's disequilibrium is evident by his slightly forceful will to play with the doll, coupled with his use of reasoning behind why he should have a chance to play with the object.

Don could have snatched the doll away, but that would jeopardize the longevity of the relationship. Betty's internal conflict revolves around her desire to continue playing with the doll, yet she makes an attempt to appease Don by saying he can have it when she is done.

INS is used to identify observed behavior along both developmental levels (Level 0 to Level 3) and interpersonal dimensions (Undifferentiated to Third person/Mutual). Developmental levels assess strategies based on their cognitive, emotional, and motivational components. Cognitive components relate to the extent to which an individual can separate the self-other distinction. Ideally, over time, individuals show growth from an egocentric view of self-other to a clear understanding of the potential differing viewpoints and perspectives between self and other, and are thus able to engage in more reciprocal and collaborative interactions (Selman & Schultz, 1989).

The emotional component refers to how individuals handle the disequilibrium of social conflict. Lower level strategies may be indicative of more uncontrollable behaviors, whereas higher level strategies include restraint and appropriate coping through reflection and communication. In a play situation where two children want to play with the same toy, one child impulsively pushing the other child out of the way to gain access to the desired toy would be indicative of a lower level emotional strategy. A child utilizing a higher level strategy may instead ask if they can both share the toy, or if one can play with it when the other child is finished.

Lastly, motivation components refer to the social goal of the chosen strategy (Selman & Schultz, 1989). Lower level strategies result in instant gratification and are

generally egocentric. In the aforementioned toy example, one child aggressively pushing another out of the way is a lower level strategy. The aggressor is able to meet his/her social goal almost instantaneously, but at the cost of being able to maintain a positive relationship with the child who was pushed. With higher level strategies, motivational goals take into account a desire to maintain the dyadic relationship long-term and often result in mutual satisfaction. For example, a child who wants access to a toy another is playing with may suggest they share the toy, or take turns playing with it.

The interpersonal dimensions revolve around three different types of social control which include other-transforming, self-transforming, and collaborative (Selman & Schultz, 1989). Other-transforming involves actions that attempt to change the thoughts and actions of others. Self-transforming encompasses actions that change one's own actions or thoughts. The collaborative dimension involves the integration of both self and other. Reliance on other-transforming and self-transforming actions is more frequent during early and middle childhood. During the adolescent period, individuals become better able to perspective-take and prioritize the longevity of their social relationships, and a shift to relying on the collaborative dimension occurs. Taken together, both the developmental levels and interpersonal dimensions comprise the entirety of the INS model.

According to Selman (1980), *Level 0* identifies strategies that are undifferentiated/egocentric. Strategies at this level are the least mature, and completely lack consideration/acknowledgement of the social partner's perspective. Such behaviors tend to be impulsive or physical (e.g., fighting).

Level 1 strategies acknowledge that a social partner may have a differing perspective of the situation. Behavioral strategies at this level are either overly willful, such as grabbing a toy or using one-way commands (i.e. “give me that”), or completely submissive (i.e. giving in). Both Level 0 and Level 1 strategies can be classified as rigid.

Level 2 and *Level 3* are indicative of an increased developmental maturity. Level 2 strategies show an understanding that the social partner may have differing opinions, views, and feelings regarding the situation. Further, any strategies used indicate the realization and reflection that the needs of each partner may differ. Such strategies could include verbal persuasion, trade suggestions, or making deals.

Level 3 strategies are considered the most mature and can be thought of as having each partner make a decision with a third-person perspective. These strategies are often collaborative, involve compromise, show a process of analysis, and include discourse revolving around shared goals.

IV. Assessment of SPS.

The assessment of SPS has largely revolved around Likert-response questionnaires, open-ended hypothetical situation response questionnaires, and observational methodologies (D’Zurilla, Nezu, & Maydeu-Olivares, 2004; Rubin & Rose-Krasnor, 1992). The strengths and drawbacks of each methodology will be discussed.

Likert-Response Questionnaires

Likert-response questionnaires are abundant in all fields of research. These questionnaires are commonly referred to as process measures when they are utilized

to assess SPS (D’Zurilla & Maydeu-Olivares, 1995; D’Zurilla, Nezu, & Maydeu-Olivares, 2004). Process measure refers to those measures that assess specific cognitive and behavioral skills that facilitate the generation and selection of various solutions.

The Social Problem Solving Inventory-Revised (SPSI-R; D’Zurilla, Nezu, & Maydeu-Olivares, 2002) is a Likert-questionnaire that involves five different scales that assess different domains of problem solving. These scales include: the Positive Problem Orientation scale (“When I encounter a problem, I usually believe there is a solution”); the Negative Problem Orientation scale (“When my first efforts to solve a problem fail, I get very angry and frustrated”); the Rational Problem Solving scale (“When I have a problem to solve, one of the first things I do is get as many facts about the problem as possible”); the Impulsivity/Carelessness scale (“When I am attempting to solve a problem, I usually act on the first idea that comes to mind”); and the Avoidance Style scale (“I usually wait to see if a problem will resolve itself first, before trying to solve it myself”). High scores on the Positive Problem Orientation and Rational Problem Solving scales coupled with low scores on the Negative Problem Orientation, Impulsivity/Carelessness and Avoidance Style scales indicate better SPS ability. Poor SPS is indicated by high scores on the Negative Problem Orientation, Impulsivity/Carelessness and Avoidance Style scales, coupled with low scores on both the Positive Problem Orientation and Rational Problem Solving scales.

The Problem Solving Inventory (PSI; Heppner & Petersen, 1982) is another commonly used Likert-scale assessment of SPS. The PSI assesses three factors related to problem solving. One factor, Problem Solving Confidence, is

conceptualized as having “self-assurance while engaging in problem solving activities”. The second factor, Approach Avoidance Style, is defined as “the general tendency to approach or avoid problem-solving activities”. Lastly, Personal Control is indicative of “the extent to which individuals believe they are in control of their behavior and emotions while solving problems. Typically a total PSI score taking into account each factor is derived.

One strength of Likert-questionnaire assessments is that they are relatively quick and easy to administer. They are not taxing for participants to fill out, and scoring each item is straightforward. These factors contribute to overall reliability of such measures, which is useful when administering the same assessment over time and across studies.

One limitation of many Likert-questionnaire assessments is the lack of evident construct validity (D’Zurilla, Nezu, & Maydeu-Olivares, 2004). Confirmatory factor analyses across various SPS tests have found little consistency across measures (Marsiske & Willis, 1995). This is largely due to the fact that many of these assessments have no foundation in a particular SPS theory or conceptualization (D’Zurilla, Nezu, & Maydeu-Olivares, 2004). Another limitation is the real-world applicability of such assessments (D’Zurilla & Maydeu-Olivares, 1995). Researchers are unable to evaluate if participants’ Likert responses would accurately map on to social problem behaviors carried out in potentially emotionally charged contexts. Moving beyond Likert-questionnaires, assessments that present participants with hypothetical social dilemmas are another popular means by which to capture SPS

abilities (Dodge, 1983; Rubin, Daniels-Beirness, & Bream, 1984; Rubin & Krasnor, 1983).

Hypothetical Situation Interviews

Hypothetical situation interviews assess the quality of specific responses to specific problems (D’Zurilla, Nezu, & Maydeu-Olivares, 2004). These interviews are open-ended social problems that participants are given to solve. Social problems may vary by context or the manipulation of the familiarity of the dyadic partner (e.g. friend versus unknown peer).

The Means-End Problem Solving Procedure (MEPS; Platt, Spivack, Altman, & Altman, 1974; Platt, Spivack, & Bloom, 1971; Spivack, Shure, & Platt, 1985) was designed to assess three hypothetical components related to means end problem solving. These components include: demonstrating the ability to conceptualize the steps necessary to attain a problem solving goal; anticipating potential obstacles that could occur during the problem solving process; and understanding that the entirety of the problem solving process may take time. The procedure itself provides participants with 10 incomplete hypothetical interpersonal problems that have a set beginning and ending. The beginning of each problem states the overall goal and the end of each problem states that the goal has been achieved. Participants are asked to fill in the middle part of the story by describing how the goal was achieved. An example hypothetical problem used from the Platt, Spivack, Altman, and Altman (1974) study is: “John noticed that his friends seem to be avoiding him. John wanted to have friends and be liked. The story ends when John’s friends like him again. You begin where he first notices his friends avoiding him” (p. 789). The scoring system

takes into account frequency of means generated, obstacles encountered, and time.

The most common score used in research is the number of means generated

(D’Zurilla & Maydeu-Olivares, 1995; Schotte & Clum, 1987).

In his SIP framework, Dodge and colleagues (Dodge, McClaskey, & Feldman, 1985; Crick & Dodge, 1994; Steinberg & Dodge, 1983) frequently used hypothetical situation interviews. The situations have been presented via illustrations, open-ended question interviews, or via videotapes with confederates acting out social conflicts.

One video may show a hypothetical scenario where two children are playing a board game. After many alternating turns, the scene then ends and the participant is asked to imagine that they want to join the children in playing the game. A series of questions are then asked, each of which is designed to tap into each of the conceptual steps that occur during SIP. For example: “How much would the first/second child like you to join and play with them?” “How do you know this?” “What could you do to get them to let you play?” The presentation of the hypothetical situations can be manipulated in a variety of ways, including changing the gender, age, or facial expressions of the children shown in the narratives.

Assessment of the INS model has utilized both coding of responses to hypothetical dilemmas as well as the coding of observed behaviors (Selman, Beardslee, Schultz, Krupa, & Podorefsky, 1986; Selman & Demorest, 1984; Yeates, Schultz, & Selman, 1991). The hypothetical dilemmas have been presented as occurring between children who are familiar with one another (e.g. friends), children who are unfamiliar with one another, adults who are familiar with one another, and

adults who are unfamiliar with one another. One example of the familiar child vignette is:

Tom and Steve are friends. They are trying to decide what to do on the weekend. Tom wants to invite the new kid in their class to see a movie with them, but Steve says he doesn't feel like having the new kid along. (Yeates, Schultz, & Selman, 1991; p. 404)

An example of the unfamiliar child vignette is:

One day a new kid in class named Bill says he's cold and asks Jeff to lend him a sweater that Jeff has but isn't wearing. The next day when Bill returns the sweater there is a hole in it that Jeff is sure wasn't there the day before.

(Yeates, Schultz, & Selman, 1991; p. 404)

Participants are then asked a series of question which tap into the various levels of the INS steps. *Defining the problem*: "what is the problem here; how do you think [both children] feel?" *Generating alternative strategies*: "tell me all the things [child A] can do to solve his/her problem with [child B]" *Selecting and implementing a special strategy*: "What would be the best way for [child A] to solve his/her problem with [child B]?" *Evaluating outcomes*: "how would [child A] and [child B] feel if [child A] did that?" (Yeates, Schultz, & Selman, 1991).

Hypothetical situation interviews are useful in that they provide more of a social context for assessing social behaviors when compared to Likert questionnaires. Additionally, researchers have more control over manipulating various aspects of the stories, such as where they occur and who the social conflicts are occurring with. Hypothetical situation assessments also allow for the breakdown of the specific steps

involved in SPS. This makes it easier for researchers to better understand where individuals may be demonstrating deficits.

Similar to Likert questionnaires, one limitation to hypothetical situation interviews is the potential lack of external validity. Research suggests the type of decision one makes regarding whether such an ambiguous act was intentional or not can vary based on a child's peer status, gender, temperament, and grade (Crick & Ladd, 1993; Quiggle, Garber, Panak, & Dodge, 1992; Wichmann, Coplan, & Daniels, 2004). If these variables are not in some way accounted for, it is difficult to tell what is driving SPS behaviors. Children who are victimized by peers appear to be especially susceptible for exercising internal, self-blame attributions for ambiguously negative events (Crick & Ladd, 1993; Prinstein, Cheah, & Guyer, 2005). Similarly, socially withdrawn children are more likely than their non-withdrawn peers to exhibit self-defeating attribution styles for social failures (e.g. "my milk spilled because I am clumsy"; Goetz & Dweck, 1980; Wichmann, Coplan, & Daniels, 2004). Aggressive children have been found to endorse external attributions and hostile attribution biases when faced with ambiguous hypothetical dilemmas (Crick & Dodge, 1996; Quiggle, Garber, Panak, & Dodge, 1992).

Many uses of hypothetical situations involve an unknown peer or adult, but substituting a known friend into the ambiguous scenarios has been found to influence SIP as well (Burgess, Wojslawowicz, Rubin, Rose-Krasnor, & Booth-LaForce, 2006). Introducing a friend into the hypothetical scenarios results in more adaptive attributions, regardless of individual differences in temperament (Burgess et al., 2006). Hypothetical situations may lack relevant contextual pressures that inform a

child's responses. Further, it is unclear if hypothetical situations are capturing what children would *actually* do in a social conflict situation, or capturing their knowledge of what they *should* do.

Observational Methodology

Observational assessments of in-vivo social interactions provide a comprehensive and sensitive look at an individual's behavior within a dyadic or group setting (Brown, Odom, & Holcombe, 1996; Isquith, Gioia, & Espy, 2004; Rose-Krasnor & Rubin, 1981; Landry, Smith, & Swank, 2006). As with hypothetical situation questionnaires, observational assessments can be manipulated to include social partners that are either known or unknown to one another

Selman and Demorest (1984) utilized the INS model in an observational study of children experiencing socio-emotional and behavior difficulties. Two children (age 9) were recruited from a day school primarily for children who display interpersonal and emotional difficulties. Both children were enrolled in pair therapy, which is especially useful for individuals experiencing social difficulties. The therapy sessions lasted over the course of two academic years. As the therapy sessions were conducted, the children were observed via a one-way mirror. Observers were equipped with a tape recorder and headphones which allowed them to hear the therapy sessions, and transcribe the observations. Specific attention was paid to interpersonal negotiation situations, and these instances were elaborated by descriptions of affective tone, nonverbal behavior, and direct verbal interaction (Selman & Demorest, 1984).

The transcripts were then coded based on the INS model. Each child's interpersonal strategies were coded for the level of the strategies they chose (0-3, or Undifferentiated/Egocentric – Third Person Mutual, based on the INS model), and the orientation of their strategy (self-transforming vs. other transforming). Over the course of the therapy, both children displayed a high frequency of Level 1 strategy use (Selman & Demorest, 1984). At the start of therapy both children showed rigidity in their strategy orientation, with one consistently selecting self-transforming strategies and the other consistently selecting other-transforming strategies. Throughout the therapy sessions one child did begin to demonstrate more flexibility in strategy orientation by shifting from both self-transforming and other-transforming. The authors (Selman & Demorest, 1984) state this highlights the therapeutic value of paired therapy with children who possess opposing strategy orientations. Children can practice the opposing strategy with one another and learn the benefits of employing an alternative orientation. Further, an INS framework combined with therapy helps break down the underlying affective, motivational, and cognitive processes that underlie a child's overt behavior (Selman & Demorest, 1984).

Rose-Krasnor and Rubin (1983) used observational methods (Appendix A) to assess the SPS skills of preschool children. This coding scheme was focused on the social goals children had during play sessions, and included capturing the various strategies children used to meet those goals, as well as the outcomes of each strategy. Children were observed during ten 30 minute play sessions at their schools and coded for behaviors related to SPS attempts, social goals, and outcomes. Narratives of the play periods were recorded and transcribed to help categorize SPS attempts.

Descriptive analyses revealed that the most commonly used goals were to obtain assistance or direct play. The second most frequent social goals were nonspecific initiations, which refer to social directives with no defined purpose other than to initiate social contact. The third most frequent goal was to elicit attention. Rose-Krasnor and Rubin (1983) point out that eliciting attention is an important foundational SPS skill. Being able to successfully gain the attention of the social partner is a paramount step in obtaining a social goal. The most frequent social strategies were questions, directives, descriptives, and orienting acts. Of all SPS instances, attempts were successful 57% of the time (Rose-Krasnor & Rubin, 1983). This study provides a useful model for reliably observing SPS, and as will be discussed below, serves as a template for the SPS coding scheme of this dissertation.

The same coding scheme and observational methodology used by Rose-Krasnor and Rubin (1983) was also used in a study by Stewart and Rubin (1995) with a sample of anxious-withdrawn children. Participating children were either in 2nd or 4th grade. To classify as anxious-withdrawn, children had to be identified as exhibiting those behaviors by both their peers and teachers. Teachers completed the Preschool Behavior Questionnaire (Behar & Stringfield, 1974), which has subscales related to internalizing factors (fearfulness, anxiety, social withdrawal). Peers were shown a display board featuring photos of all classmates. Descriptions of socially average (“Someone who is good to have in a group because they cooperate”), socially withdrawn (“Someone who acts shy around other kids”), and socially aggressive (“Someone who gets into a lot of fights”) behaviors were then given, and peers were asked to point to the child who best fit each description. Of the children who were

identified as anxious-withdrawn, 8 from 2nd grade and 11 from 4th grade participated in a laboratory visit with their mother. Additionally, eight 2nd grade children and eight 4th grade children who were identified as socially average also participated in the laboratory visit as a comparison group.

The laboratory visit consisted of a play session with numerous components. The play session was structured as follows: a clean up session where crumpled paper was placed around the room and the mother was asked to have her child put the paper in the trash can; a free play session; a second free play session where an unfamiliar mother-child dyad from a comparison group of non-anxiously withdrawn children was brought into the room; a third free play session where the mother of the socially average child left the room (triadic free play); a session where a novel toy was introduced; and a block building task with just the mother-child dyad from the anxious-withdrawn group where the child was asked to replicate a Lego figure. The observational coding scheme was utilized for the block building, novel toy, and triadic free play session (Stewart & Rubin, 1995).

Stewart and Rubin (1995) were interested in examining group differences in social initiations, as well as differences in the frequency of high cost goals and low cost goals. The “cost” of a goal was determined by the amount of effort the target would need to exert. High cost goals were those which required active compliance from the target (e.g. object acquisition, initiating play). Low cost goals were those which required very little effort from the target (e.g. attention seeking, requests for information).

Results revealed that anxious-withdrawn children made fewer social initiations compared to their socially typical peers, regardless of grade. There were no group differences in the production of high cost versus low cost goals. However, compared to their socially typical counterparts, anxious-withdrawn children were less likely to use assertive strategies (e.g. commands), and more likely to use passive strategies, such as indirect requests. Lastly, anxious-withdrawn children, when experiencing a social failure, were less likely to follow up and re-attempt to obtain their social goal (Stewart & Rubin, 1995). This study provides further useful utility of the Rose-Krasnor and Rubin (1983) coding scheme for SPS. Additionally, Stewart and Rubin (1995) addressed critical points regarding individual differences in social behavior as they relate to SPS and social competence.

The observational SPS coding scheme utilized by both Rose-Krasnor and Rubin (1983) and Stewart and Rubin (1995) extends what can be gathered from hypothetical situation dilemmas by capturing the outcomes that occur following SPS goals and strategies. An SPS strategy assessed within the hypothetical situation framework may be a less mature developmental strategy, but one that results in a success during a real-time interaction. Having a record of the SPS outcomes, and responses to those outcomes, is also useful when assessing differences in the SPS behaviors of friends, versus known peers, versus unknown peers.

Additionally, the coding scheme first used by Rose-Krasnor and Rubin (1983) demonstrates the sequencing of specific SPS goals and SPS strategies. With this information, one could examine whether a dyad is more or less likely to use a breadth of SPS strategies for certain SPS goals, or if they tend to be rigid in their selection of

SPS strategies. It may very well be the case that best friend dyads exhibit different SPS strategy selection compared to two social partners who strongly dislike, or are unknown to, one another.

Observational methodologies are useful in that they are ecologically sensitive (Berndt & McCandless, 2009; Brown, Odom, & Holcombe, 1996; Landry, Smith, & Swank, 2009). By observing the behaviors of children as they play in a naturalistic environment, more nuanced coding schemes can capture subtle social behaviors. Additionally, as with the hypothetical situation dilemmas, researchers can manipulate various aspects of the task environment such as who the social partners are and what the immediate task involves. Unlike research with Likert-questionnaires and hypothetical situation dilemmas, there is a dearth of research that uses observational methods to study SPS.

One obvious limitation of observational methodology is that it is labor intensive. Either capturing video or having research assistants live-code participants in a laboratory setting or a home/school setting is more arduous than having participants complete survey questionnaires. Additionally, others argue that live coding via observation carries with it potential threats to validity. For example, D’Zurilla and Maydeu-Olivares (1995) state that when observing an adaptive and appropriate solution to a problem, that behavior may be confounded by a coder’s poor interpersonal skills.

As was highlighted as one of the strengths of observational methodology compared to Likert questionnaires or hypothetical scenarios, the ability to manipulate the social partners in the task environment is significant. Research has shown that a

child's response to a social problem can greatly vary depending on the social partner whom they are interacting (Azmitia & Montgomery, 1993; Burgess, Wojslawowicz, Rubin, Rose-Krasnor, & Booth-LaForce, 2006; Strough, Berg, & Meegan, 2001). For example, an individual's SPS that occurs with a friend may be different than SPS occurring with an unfamiliar peer.

V. Friendship and Social Problem Solving

Friendship, defined as a voluntary and reciprocally affective relationship, can impact the nature of SPS between two individuals (Bukowski, Motzoi, & Meyer, 2009; Rubin, 2004). In a problem solving context, friendships carry with them a shared interactional history rife with numerous instances of collaboration, conflict, and resolution (Newcomb & Bagwell, 1995; Strough, Berg, & Meegan, 2001). In order to preserve the friendship, friends are more likely than non-friends to choose negotiation or compromise as a strategy, and less often to choose power assertive or aggressive strategies when faced with a problem (Laursen, Finklestein, & Betts, 2001). For friends, the main priority is to maximize the likelihood of maintaining a long-term relationship, and therefore concessions are more easily reached and acquiesced.

Developmentally, friendship and SPS begin to integrate heavily with one another during middle childhood and throughout adolescence. Middle childhood represents a period of development when children begin to choose their own friends, and rely on those relationships for advice and comfort more so than relationships with parents (Hartup, 1996). This increased time with the peer group and with friends provides increasing instances requiring the demonstration of social skills including

negotiation, conflict resolution, and collaboration (Laursen, Finklestein, & Betts, 2001; Laursen & Pursell, 2009). Along with the increase in opportunities to practice these social skills, children at this age are also aware of possible conflicting needs and desires of their social partner. Thus, friends have to learn adaptive ways to tactfully navigate differences of opinion in order to reach a mutually beneficial outcome (Laursen, 1996; Newcomb & Bagwell, 1995). While the building blocks of SPS develop early in life, friendships help hone these skills by providing a safe context to air grievances or challenge another's opinion (Hartup & Laursen, 1993; Laursen & Pursell, 2009).

Newcomb and Brady (1982) provided one early example of a study where SPS was observed with 2nd ($n = 91$) and 6th ($n = 79$) grade boys who were paired with either a friend or an acquaintance. The dyads were instructed to work together to solve a puzzle box. The puzzle box had 15 features to it, five of which could be manipulated by one individual, five which needed two people to manipulate, and five features which could be manipulated by either one or two individuals. The puzzle box task was videotaped and coded for the following SPS behaviors: communicative exchanges, affective expressions, synchrony of task-oriented behavior, and task performance. Regardless of age, children who were paired with their friends were more likely to engage in behaviors that required two people, engage in exploration together, and engage in mutual affection (e.g., laughter) than those paired with acquaintances (Newcomb & Brady, 1982). Although possibly gender specific, this study highlights the differences in both affect and behavior that friends exhibit compared to non-friends.

Strough, Berg, and Meegan (2001) examined the effects of both friendship and gender on a peer collaboration task. Eighth graders ($N = 82$) were tasked with working on a 6 week Spanish project together in a five-person group with either same gender peers or same gender friends. A five point Likert scale was developed to assess both task-related problems (e.g. time is running out to complete the project) and social problems (e.g. one person is not doing any work) throughout the course of the project. Over time, task-related problems decreased whereas social problems increased. However, regardless of gender, groups that were formed with friends had reduced instances of both task and social problems throughout the 6 weeks. Social problems were reported as less frequent in groups of females compared to groups of males, regardless of group. These results also coincide with the aforementioned literature suggesting SPS within a friendship context differs from SPS with peers or acquaintances.

Lastly, friendship quality is important when considering SPS. Friendship qualities can be positive; that is, they can comprise such positive features as cooperation, intimate disclosure, and affection. Friendship qualities can also be negative, comprising such characteristics as conflict and antagonism (Bukowski, Motzoi, & Meyer, 2009; Rubin, Fredstrom, & Bowker, 2008). Researchers have examined how friendship quality potentially serves as a moderating factor for other child related variables (Berndt, 2002; Bollmer et al., 2005; Bowker et al., 2007; Hodges et al., 1999).

Hodges and colleagues (1999) examined if friendships qualified as protective moderated the relation between behavioral problems and peer victimization. The

study was comprised of 393 fourth and fifth grade students who completed measures related to their friendships and classmates' peer victimization. Teachers rated students on internalizing and externalizing problems. While internalizing and externalizing behaviors predicted increases in peer victimization, this relation was attenuated for the association between internalizing behaviors and victimization for students who reported having protective friends. Students who did not report a mutual friendship and who were victimized were more likely to report internalizing or externalizing behaviors. The authors highlighted these findings in the context of considering the buffering effect against peer victimization that protective friendships provide for children who exhibit behavioral problems (Hodges et al., 1999).

Bollmer and colleagues (2005) also examined the potential moderating role of friendship quality for risk factors predicting peer victimization and bullying. Specifically, the authors hypothesized that children who exhibited internalizing symptoms, but had high quality friendships, would experience less peer victimization compared to children who had internalizing symptoms and rated their friendships as being low in quality. Children between 10 and 13 years of age ($N = 99$), completed measures related to friendship quality, peer support, and reactive and proactive aggression. Children also participated in a semi-structured interview designed to assess their experiences with peer victimization. Parents completed measures regarding their child's experiences with peer victimization, and rated their child's social and behavioral competencies.

Results indicated that friendship quality did moderate the relation between externalizing problems and bullying. Specifically, children who were reported as

displaying externalizing behaviors were less likely to bully their peers if they reported high quality friendships. Children who exhibited externalizing behaviors and reported low quality friendships were more likely to engage in bullying behaviors. The authors did not find similar results to the Hodges et al. (1999) study regarding the moderating function of friendship quality between internalizing symptoms and peer victimization, although Bollmer and colleagues (2005) did not utilize reciprocal friendship nominations. The authors suggested the findings underscore a potentially critical role friendship quality may play in attenuating bullying behaviors.

Bowker, Rubin, Rose-Krasnor, and Booth-LaForce (2007) explored the role that friendship quality played in the association between aggression and social information processing behaviors. Students from 5th and 6th grade ($N = 385$) completed measures related to their friendship quality and the aggressiveness exhibited by their best friend. All students nominated their peers based on a measure of various social behaviors (aggression, shyness/withdrawal, popularity, victimization, and prosociality). Students also completed a measure assessing their social information processing via hypothetical reasoning scenarios. Bowker and colleagues (2007) explored questions related to how best friends' aggressiveness and friendship quality were associated with social information processing and coping. Results suggested that similarly aggressive friends who rated their friendship quality as highly positive demonstrated fewer vengeful coping styles. The authors argued that these findings suggest friendships qualified as highly positive between two similarly behaved friends may promote more adaptive ways of coping with conflict and perceived negative social events.

While not many studies have explicitly studied the impact of friendship quality on SPS, friendships rated as highly controlling have been associated with more frequent and intense conflicts (Updegraff et al., 2004). When facing conflict, friends who rate their relationship as supportive are less likely to endorse revenge as a goal (Rose & Asher, 1999). Taken together, the literature on friendship, collaboration, and problem solving suggests that high quality friendships are more likely to effectively carry out SPS tasks, in an effort to preserve the relationship.

These models and assessments of SPS and friendship have been largely discussed within the context of a normative developmental framework. With the increasing focus on the connection between the brain and social behavior, researchers who study clinical populations have begun to integrate models from developmental psychology and other relevant areas into their methodologies (Crone & Ridderinkhof, 2011; Guroglu et al., 2008; Ross, McMillan, Kelly, Sumpter, & Dorris, 2011; Yeates et al., 2007). One specific clinical population that is gaining ground on research related to social processes and social outcomes such as SPS and friendship is children who have experienced a traumatic brain injury (Janusz et al., 2002; Hanten et al., 2008).

VI. Social Problem Solving and Children with Traumatic Brain Injury

Traumatic brain injury (TBI) has been reported as one of the leading causes of death and acquired disability in children and adolescents (Center for Disease Control, 2010). Researchers have begun to examine how brain injury impacts the behavioral, emotional, cognitive, and social development of children (Heverly-Fitt et al., 2014; Rosema, Crowe, & Anderson, 2012; Walz et al., 2009; Wolfe et al., 2014; Yeates et

al., 2007). Children diagnosed with TBI are more likely to be characterized as impulsive, aggressive, agitated, apathetic and irritable (Janusz et al., 2002). Children with TBI are likely to self-report high levels of loneliness and low levels of self-esteem (Andrews et al., 1998; Janusz et al., 2002). They are also likely to show declines in memory, attention, intelligence, executive functions and non-verbal skills (Janusz et al., 2002) and are often rated as being less socially competent compared to non-injured children (Walz et al., 2009).

Yeates and colleagues (2007; Figure 1) proposed an integrative heuristic that outlines how social information processing, social behaviors, and social adjustment are influenced by injury-related factors (e.g. severity of brain injury, type of insult) as well as non-injury factors (e.g. family functioning, parenting style). The model takes into account how injury-related factors can have impacts at the individual level, dyadic level, and group level. At the individual level, injury can affect cognitive-executive functions, social problem solving abilities, and social-affective functions. Deficits in the functioning of these processes impact the nature of social interactions, for example potentially resulting in increases or decreases in the display of affiliative, withdrawn, and aggressive behaviors. At the group level, these social interactions contribute to both self and other perceptions of social adjustment. Using this model as a guide, we can begin to see how brain injury in childhood can have implications for social and cognitive development.

Before a more detailed discussion of how SPS is assessed in children with TBI, it is relevant to note that often times children who have experienced an orthopedic injury (OI) are used as a comparison group. Children with OI are

commonly used in this capacity in order to control for the possibility that any differences found in children with TBI are simply due to the experience of being hospitalized or due to the general trauma of having a bodily injury (Yeates et al., 2004). What is less common in studies involving children with TBI is the use of *both* an OI group and a non-injured control group.

Assessment of Social Problem Solving

Interpersonal Negotiation Strategies (INS; Yeates, Schulz, & Selman, 1990). The INS interview has been the most prominent assessment of SPS with this clinical population. When utilizing the INS assessment, children with TBI have been presented with various hypothetical interpersonal dilemmas, and subsequently prompted to define the problem, generate strategies, select and implement a strategy, and evaluate the outcome.

Janusz et al. (2002) examined SPS of children with TBI as those skills related to long-term social and academic outcomes. The sample included children with moderate ($n = 40$) to severe ($n = 35$) TBI, along with children with OI ($n = 46$). TBI severity was assessed using the Glasgow Coma Scale (GCS; Teasdale & Jennett, 1974; Appendix B). All participants were approximately 13 years old at the time of testing. SPS for both groups was assessed via the INS measure.

Children were presented with two hypothetical dilemmas occurring with either a peer or a parent. Following the dilemmas, questions were asked to ascertain the INS problem solving steps (e.g. “What is the problem here?” “What are all the different things [the protagonist] can do to solve his/her problem with [the other person]?”). Each hypothetical dilemma interview was recorded and transcribed. The

transcriptions were then scored based on the developmental level of each response within the INS framework.

The TBI and OI groups did not differ in terms of how they assessed the hypothetical social dilemmas or in their generation of alternative strategies. However, children with severe TBI reported lower-level strategies as the best way to solve dilemmas, and indicated lower-level reasoning when evaluating the effectiveness of their strategies. These results highlight the multidimensionality of SPS by indicating that an individual can be both effective and ineffective on various processes relating to SPS.

In a longitudinal study, Yeates and colleagues (2004) were interested in the degree to which SPS skills contributed to social outcomes (i.e. social competence, social functioning) over time. The study also tested a conceptual model proposing that SPS skills mediated the relations between executive functions, pragmatic language, and social outcomes.

The sample included both children with moderate ($n = 56$) and severe ($n = 53$) TBI, as well as children with OI ($n = 80$). Participants ranged from 6-12 years of age. Injury status was assessed using the Glasgow Coma Scale (Teasdale & Jennett, 1974).

Executive function was measured via the Contingency Naming Test (CNT: Anderson et al., 2000), which is a speeded naming task that assesses working memory, inhibitory control, verbal rule learning, and mental flexibility. Pragmatic language was measured with the Test of Language Competence – Expanded Edition (TOLC; Wiig & Secord, 1989). Subtests of the TOLC assess the ability to interpret idioms and metaphors within a specific context, and the ability to provide

contextually appropriate utterances using only a few words. To assess SPS, participants were presented with INS hypothetical situations that involved social conflicts with both a peer and a parent. A global INS total score that collapsed scores across each problem solving step (i.e. defining the problem, generating alternative strategies, selecting and implementing a specific strategy, and evaluating the outcome) across both contexts was used in analyses. Lastly, social outcomes were measured via parent report on the Social Competence and Social Problems subscales of the Child Behavior Checklist (CBCL; Achenbach, 1991), and the Socialization subscale of the Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984).

Hierarchical regression analyses revealed associations among the variables of interest, although there was not enough statistical evidence to support a full mediation model. Both executive function and pragmatic language predicted social problems and socialization, but not social competence. Conversely, SPS was a significant predictor of social competence only. The independent and collective influences of executive function, pragmatic language, and SPS on each of the three social outcomes underscore the complexities of understanding how cognitive and social processes influence one another for children who have experienced a TBI. These results further emphasize the need for a more comprehensive understanding of how SPS is influenced by TBI and what other mechanisms may contribute to, or be effected by, deficits in SPS behaviors.

Hanten et al. (2008) examined the SPS of children with TBI at three and twelve months post injury in order to better understand how SPS are affected by such

an injury over time. Participants ranged in ages from 7 to 17 years ($M = 12.16$, $SD = 2.7$). Both children with moderate to severe TBI ($n = 52$) and children with OI ($n = 51$) participated. Injury severity was assessed using the Glasgow Coma Scale (Teasdale & Jennett, 1974).

To capture SPS, Hanten et al. (2008) used the same methodology as Janusz et al. (2002) by incorporating the INS interview. Each problem solving step of the INS (i.e. defining the problem, generating alternative strategies, selecting a specific strategy, and evaluating the outcome) was assessed with hypothetical dilemmas involving an adult or same age child. To examine change in SPS over time, each INS step was entered as a predictor variable in growth curve analyses for children with TBI and OI.

Overall, the TBI group scored lower on SPS compared to the OI group at each time point. Specifically, the authors (Hanten et al., 2008) found that children with TBI were more likely to generate problem-solving strategies that are more impulsive and egocentric (Hanten et al., 2008). There were no differential improvements in SPS for either group across all of the time points. Both children with TBI and children with OI chose higher level strategies when presented with a dilemma that involved a same-age peer, compared to an adult, further highlighting the importance of considering who the social partner is.

As a follow-up study, Hanten and colleagues (2008) used the same sample and examined the possible associations between SPS and cognitive and emotional processing. SPS was again assessed using the same INS measure from the first study. Cognitive processing measures assessed inhibition (Flanker No-Go Task; Bunge et

al., 2001), speeded processing (Flanker Task baseline reaction time), memory (Sternberg Item Recognition; Sternberg, 1966) and language (Woodcock Johnson Tests of Achievement – III; Woodcock & Mather, 1989). To assess emotional processing the Facial Emotion Sorting test (Adolphs, Tranel, & Damasio, 2001) was utilized. Lastly, to assess broad social outcomes the Vineland Adaptive Behavior Scale-Revised (VABS-R; Sparrow et al., 1984) was used.

For children with OI, performance on memory and language tasks was strongly related to SPS. These associations were less robust for children with TBI. Surprised by the lack of findings relating inhibition and SPS, the authors (Hanten et al., 2008) suggested that the INS measure may be more accurate in assessing the child's capability of thinking through the presentation and solution to hypothetical social dilemmas, rather than how they behave in a naturalistic setting. Further, they noted the possibility that SPS deficits in children with TBI may be underestimated in laboratory settings given the structured assessment of SPS. The INS may provide a structure for social processing that is not present during naturalistic social interactions (Hanten et al., 2008). Observational studies of SPS are non-existent in this specific population, and would add to a more nuanced understanding of the actual interpersonal problem solving skills of children with TBI.

More recently, Hanten and colleagues (2011) used the INS framework within a virtual reality SPS task in adolescents with TBI. The study was the first of its kind to incorporate a more naturalistic environment for the study of SPS following pediatric TBI. In addition to the use of virtual reality technology, the authors (2011) also examined the associations between SPS and cortical thickness.

Participants with TBI ($n = 28$) ranged in ages from 12 to 19 years of age. Severity of TBI, as determined by the Glasgow Coma Scale (Teasdale & Jennett, 1974), included 15 participants with moderate to severe TBI, and 13 participants with mild TBI. A typically developing group ($n = 13$) that was matched by age, gender, and parental education was also recruited.

The virtual reality task was run through Second Life, an online 3-D virtual world. The task was set up so that participants viewed six scenarios involving four virtual reality characters. Two of the virtual reality characters were involved in conflict. The scenarios involved either a Parent-Child or Youth-Peer interaction. For each scenario, the gender of the virtual reality characters who were in conflict was matched with that of the participant.

The scripts of the scenarios were integrated from the INS framework. Participants viewed six of eight potential scenarios. For the parent-youth conflict the four scenarios included conflicts over babysitting, staying home alone, attending a school fair, and making dinner. For the youth-peer conflict the four scenarios included asking someone else out, a hole being left in a jacket, a new kid at school, and leaving work early.

Each of the eight scenarios included three possible conditions that varied the amount of relevant and irrelevant information being offered by the virtual reality characters. Condition A showed the two characters in conflict providing information only relevant to the conflict. The additional two characters remained silent. In Condition B, the two characters in conflict provided both relevant and irrelevant information regarding the conflict, and the additional two characters remained silent.

In Condition C, the two characters in conflict again provided both relevant and irrelevant information regarding the conflict, and the additional two characters offered information that is tangential to the conflict. Examples of each of these conditions for the parent-youth conflicts included:

Condition A: No irrelevant information is provided. Two females are in conflict, two males observe.
Mom: Lily, I have to work late tonight
Lily: You have to work late again? What are we going to have for dinner?
Mom: It would be great if you could make something at home
Lily: Mom, I'm tired of the food we have here. Can't we just order out?
Mom: We have plenty of food. Besides, ordering out is expensive
Lily: But I don't know what to make for dinner and we never order out
Mom: Lily, we have all the ingredients to make tuna salad, just make that and we'll have sandwiches
Lily: C'mon mom. It's Friday and we have tuna all the time. Can't we just get a pizza?
Mom: It's the end of the month and we're tight on money

Condition B: Two females in conflict provide relevant and irrelevant information. Two males observe
Mom: Lily, how was that field trip? Oh by the way I have to work late tonight
Lily: You have to work late again? What are we going to have for dinner? The field trip was ok, I've been to that museum before
Mom: Did they have any new exhibits? It would be great if you could make something at home
Lily: They had a new exhibit about the Egyptians. Mom, I'm tired of the food we have here. Can't we just order out?
Mom: We have plenty of food. Besides ordering out is expensive. I'd love to see the pyramids in person
Lily: (whining) But I don't know what to make for dinner and we never get to order out
Mom: Lily, we have all the ingredients to make tuna salad, just make that and we'll have sandwiches.
Lily: C'mon mom. It's Friday and we have tuna all the time. Can't we just get pizza?
Mom: It's the end of the month and we're tight on money

Condition C: Two females in conflict provide relevant and irrelevant information. Two males give only irrelevant information.
Mom: Lily, how was the field trip? Oh by the way, I have to work late tonight

Lily: You have to work late again? What are we going to have for dinner? The field trip was ok, I've been to that museum before
 Jack: Yeah, what did they have at the museum this time?
 Lily: They had a new exhibit about the Egyptians. Mom, I'm tired of the food we have here. Can't we order out?
 Mom: We have plenty of food. Besides ordering out is expensive. I'd love to see the pyramids in person
 Dad: We should do that for our next anniversary
 Lily: (whining) But I don't know what to make for dinner and we never get to order out
 Mom: Lily, we have all the ingredients to make tuna salad, just make that and we'll have sandwiches.
 Lily: C'mon mom. It's Friday and we have tuna all the time. Can't we just get pizza?
 Mom: It's the end of the month and we're tight on money (Hanten et al., 2011, 489-490).

Participants viewed all three conditions for both the parent-child scenario and the youth-peer scenario, resulting in a total of six scenarios. Directly after each scenario the participant was interviewed using the INS framework with questions probing for defining the problem (e.g. "What is the problem here? Why?"), generating strategies (e.g. "What can you think of that Lily can do to solve the problem?"), selecting the specific strategy (e.g. "What is the best way to solve the problem?"), and evaluating the outcome (e.g. "How would Lily and her mom feel if Lily did that?"). Responses were scored indicating the developmental level of the participant's response (impulsive = 1 point, unilateral = 2 points, reciprocal = 3 points, or collaborative = 4 points). For each of the four SPS steps a summary score was created with higher scores representing more adaptive and mature SPS.

To examine cortical thickness all participants underwent magnetic resonance imaging, and FreeSurfer software was used to analyze the imaging scans. The summary scores from Condition C, considered to be the most sensitive to SPS cues, were analyzed

along with the imaging data to examine associations between the specific SPS steps and cortical thickness.

Adolescents with TBI were more likely to provide impulsive and self-centered solutions to conflicts, compared to the typically developing group. Condition C resulted in the greatest difference between the TBI and typically developing group, although Condition C was the most difficult condition for both groups. Across the INS SPS steps, the TBI group had the most difficulty defining the problem. The authors (2011) attributed this to inherent differences in the standard INS spoken narrative where participants are told all relevant information. For example:

Steve and Carl are friends. At school they are trying to decide what to do on the weekend. Steve wants to invite the new kid in their class to see a movie with them, but Carl says he doesn't feel like having the new kid along (Hanten et al. 2011, pp. 493).

In the above scenario information relating to the relationship between the characters is provided, as well as Carl's thoughts about the situation. In the virtual reality task such information needs to be inferred. The equivalent script for the virtual reality task is:

Luis: Hey Devin. What are you up to this weekend?
Devin: Not much. What about you?
Luis: Well, I was thinking we could go see that movie that just came out.
Maybe we could invite that new kid, Brandon from biology
Devin: A movie sounds cool, but I don't know about Brandon
Luis: That movie looks awesome. Why don't you want Brandon to go?
Devin: Brandon gets on my nerves
Luis: I hung out with him last week and he was pretty cool
Devin: I don't know
Luis: Dude, give him a chance (Hanten et al., 2011, pp. 493).

More inference may be needed to understand that Devin's response of "I don't know about Brandon" equates with his saying "I don't like Brandon". These subtler cues may be more difficult for adolescents with TBI to pick up on when they are not explicitly stated.

When examining associations between the SPS steps and the imaging data, it was found that the TBI and typically developing groups differed significantly in the relation between cortical thickness of the medial orbitofrontal region and the cuneus for all SPS steps with the exception of defining the problem. The orbitofrontal region has been implicated in relating to emotion and reward based decision making. The cuneus is commonly associated with visual processing, but has also been related to cognitive and inhibitory control.

Differences between groups were especially prevalent in the medial prefrontal cortex, where the typically developing group had negative relations for the evaluation of outcomes step and cortical thickness, but the TBI group showed a slight positive association between the evaluation of outcomes and cortical thickness. Due to the general nature of TBI, there is a high likelihood the prefrontal and orbitofrontal areas were comprised during injury, and the authors (2011) concluded that the TBI group's impulsive and egocentric SPS strategies may be the result of damage to these regions.

Hanten and colleagues (2011) replicated previous findings (Hanten et al., 2008) indicating that children and adolescents with TBI prefer impulsive and egocentric SPS strategies. The virtual reality methodology used provides important and relevant results regarding the assessment of real-world problem solving. The traditional INS scripts may be providing subtle social information that in a real world

setting would be difficult to pick up on or process for youth with TBI. This further speaks for the exploration of more realistic settings to assess behaviors related to SPS with this clinical population.

Social Problem Solving Inventory. The SPSI-Revised (D’Zurilla, Nezu, & Maydeu-Olivares, 2002) has also been used to assess SPS in children with TBI. Muscara, Catroppa, Eren, and Anderson (2009) tested the previously mentioned Yeates et al. (2004) proposed model in order to see if SPS mediated the relation between executive function and social outcomes in children with TBI. Adolescents and young adults (16-22 years, $n = 36$) who had previously experienced a brain injury were recruited from a larger longitudinal parent study. The Glasgow Coma Scale (Teasdale & Jennett, 1974) was used to assess injury severity; the sample included 13 mild TBI, 17 moderate TBI and 6 severe TBI participants.

Predictor variables included executive function and SPS. The Behavior Rating Inventory of Executive Function – Parent version (BRIEF; Gioia, Isquith, Guy, & Kenworthy 2000) was utilized to assess executive functions related to cognitive flexibility, attention, working memory, problem solving, and verbal fluency. SPS were assessed using the Social Problem Solving Skills Inventory-Revised (SPSI-Revised; D’Zurilla, Nezu, & Maydeu-Olivares, 1998). Specifically, the combined global score was used in analyses as a predictor variable.

Social outcome measures included the Adaptive Behavior Assessment System – Second Edition (ABAS-II; Harrison & Oakland, 2003) which captures social functioning (i.e. social skills, interpersonal relationship skills). The Sydney Psychosocial Reintegration Scale (SPRS; Tate, Hodgkinson, Veerabangsa, &

Maggiotto, 1999) was used to examine social reintegration following TBI. Lastly, the Social Skills Rating System (SSRS; Gresham & Elliot, 1990) assessed outcomes related to cooperation, assertion, self-control, and responsibility.

Since the severe TBI group was so small it was collapsed with the moderate TBI group for analytic purposes. Findings relevant to SPS were minimal, but telling. While predictors related to injury severity, executive functioning, and SPS combined for a large portion of the variance in predicting social reintegration, when tested individually, SPS was the only independent predictor that significantly predicted social reintegration (Muscara et al., 2009).

These results provide a narrative that highlights the long-term importance of adaptive and mature SPS following childhood TBI. Head injury during childhood can impact the development of cognitive mechanisms implicated in social functioning, which if not addressed may have residual effects lasting into adulthood.

Attributions and Coping Questionnaire. The ACQ (Burgess et al., 2006) was designed to assess social information processing in the context of both peers and friends. Hypothetical vignettes provided ambiguous provocation scenarios. For example:

Imagine you are sitting at the lunch table at school eating lunch. You look up and see another kid coming over to your table with a carton of milk. You turn around to eat your lunch, and the next thing that happens is that the kid spills milk all over your back. The milk gets your shirt all wet. (Burgess et al., 2006, pp. 375)

The responses to each vignette capture the child's attributions, emotional reaction, and coping strategies. For attributions four choices were provided to choose from: 1) prosocial (e.g. The child slipped on something); 2) external blame (e.g. The kid wanted to make fun of me); 3) internal blame (e.g. I must have done something to make it happen); 4) and neutral (e.g. The kid didn't see me).

For emotional responses participants chose one of four responses: ok, sad, angry or embarrassed. Coping styles were assessed by selecting from one of five options: 1) avoidance (e.g. I'd leave the lunchroom); 2) adult intervention (e.g. Ask the teacher to get a towel); 3) revenge (e.g. Pour the milk on the child's back the next day); 4) emotional (e.g. I would do nothing but I'd be upset); 5) appeasement (e.g. Tell him/her it is okay because these things happen to everyone).

The ACQ is divided into two parts. Part One includes a peer from school as the perpetrator, whereas Part Two has a predetermined best friend as the perpetrator. All of the follow up questions to assess attributions, emotion reaction, and coping styles are the same for each part.

Moran et al. (2015) used the ACQ to assess the associations between SPS and social adjustment in children with TBI. It was hypothesized that children with TBI would be more likely to interpret ambiguous situations as hostile and more likely to choose aggressive, avoidant, or irrelevant responses compared to children with OI. Further, the authors (2015) expected SPS to mediate the relation between injury status (TBI or OI) and social adjustment.

Participants were drawn from the Social Outcomes of Brain Injured Kids (SOBIK) study, which explored social outcomes following childhood TBI. TBI and

OI participants from the SOBIK study were the same sample used for the current dissertation. Children with TBI ($n = 82$) and children with OI ($n = 61$) were between 8 and 13 years of age. TBI severity ranged from complicated mild ($n = 57$) to severe ($n = 25$) and was assessed using the Glasgow Coma Scale (Teasdale & Jennett, 1974).

In addition to using the ACQ to assess SPS, social adjustment was captured using peer sociometric ratings, parent report with the ABAS-II (Harrison & Oakland, 2003) and the Behavior Assessment System for Children- Second Edition (BASC-2; Reynolds & Kamphaus, 1992). Best friend names for Part Two of the ACQ were obtained from friend nominations. Both children with TBI and children with OI were asked to list their three best friends. Reciprocated nominations were considered to be mutual friendships.

Many findings were contrary to the authors' (2015) hypotheses. Children with TBI were less likely to choose avoidance as a strategy and did not show a preference for aggressive emotional reactions. Further, children with TBI were less likely to choose external blame as an attribution to the vignettes, and the TBI and OI groups did not differ on preference for vengeful actions. Children with TBI were more likely than the OI group to choose adult intervention as a strategy, and children with severe TBI were more likely to choose "sad" as an emotional reaction to the vignettes. In general, both children with TBI and OI modified their responses when the perpetrator switched from a peer to their friend. This indicates children with TBI recognize when social contexts allow for different responses and reactions. Broadly, the findings suggest that children with TBI demonstrate more indirect responses as well as deficits in emotion regulation when faced with a social problem (Moran et al., 2015).

Moran et al. (2015) were not certain if the ACQ findings were indicative of the actual SPS skills of children with TBI, or if the findings were due to limitations of the ACQ measure. For example, the ACQ may be simply assessing social skill knowledge and not what children with TBI would do in an actual real-world situation. Additionally, the ACQ only assesses three steps of the SIP process, and neglects other steps such as strategy response generation (how many strategies did you have to choose from). Participants may have also been limited by the forced multiple choice format.

In testing the proposed mediation model, clinical significance was limited. SPS variables related to making fewer external blame attributions and choosing fewer avoidant strategies mediated the relation between injury status and social adjustment. However, the statistical difference equated to half a standard deviation difference between the TBI and OI groups, which is why the clinical significance of the mediation model findings was characterized as minimal.

Within the existing literature on SPS in children with TBI common themes seem to repeat across studies. Children with TBI are more likely than children with OI to endorse lower level strategies, these include impulsive, avoidant, or egocentric strategies. Children with TBI seem sensitive to the social context of a conflict, for example adapting their responses if the conflict were to involve same age peers versus an adult. One largely unexplored empirical question relates to how the social relationships of children with TBI might influence their strategy response, and thereby possibly their SPS success rate, in an actual SPS situation.

Friendship and Social Problem Solving.

In typically developing non-injured children, friendship has been found to promote social skill growth, provide contexts for emotional support, and allow for the expression and regulation of affect (Denton & Zarbatany, 1996; Newcomb & Bagwell, 1995; Rubin, Fredstrom, & Bowker, 2006). Further, the presence of a friend has been found to mitigate negative social outcomes (e.g. peer victimization and rejection) as well as protect against internalizing symptoms (Adams, Santo, & Bukowski, 2011; Hodges, Boivin, Vitaro, & Bukowski, 1999; McDonald et al., 2013). Recent research has begun to explore the friendships of children with TBI. The primary focus has been to examine the nature of these relationships within this population, and how friendship may influence the psychosocial development of a child who has experienced a TBI (Bohnert, Parker, & Warschausky, 1997; Heverly-Fitt et al., 2014; Ross et al., 2011).

The first step for researchers interested in childhood TBI has been to assess whether or not children with TBI have friends, and if so, to characterize these relationships. This is especially relevant if a TBI occurs during periods of development when friends are especially significant and influential, as the social, cognitive, and emotional implications may be even more crucial. The next step should be to analyze associations between friendship and other socio-cognitive processes, such as SPS.

In an earlier study examining friendship and social adjustment, Bohnert, Parker, and Warschausky (1997) examined differences between children with TBI ($n = 22$, M age = 12.7) and a non-injured group ($n = 22$) who were matched on sex, race, and age. Injury severity was assessed using the Glasgow Coma Scale (Teasdale &

Jennett, 1974), and the sample included 15 children with severe TBI, and 7 children with mild-moderate TBI.

All participants provided information identifying how many friends they had (Peer Social Support Network; Parker & Herrera, 1995), frequency of contact with those friends (Peer Social Support Network; Parker & Herrera, 1995), and the quality of those friendships (FQQ; Parker & Asher, 1993). Parents rated their children on a scale that assessed general academic competence, social competence, athletic competence, behavioral conduct, and physical appearance (Ratings of Child's Competence; Harter, 1986).

Children with TBI reported friendship networks and quality that were generally comparable with the matched control group (Bohnert, Parker, & Warschausky, 1997). Conversely, parents of children who had sustained a TBI were more likely to rate their child as being less socially competent. This study was one of the first to assess associations between social adjustment and friendship within this population, and is important because it suggests that experiencing a TBI in childhood may not have detrimental effects on close friendships. It also highlights a potential discrepancy between self and parent report of social competence. Parents may be more attuned to how their child is interacting with the general peer group and not just with their friends. It could also be the case that parental reports of their children's social competence is not as reliable in middle childhood when children spend more time with their peers, and less time with their parents.

More recently, Ross et al. (2011) examined the associations between friendship quality, loneliness and psychosocial functioning in children with TBI. The

sample included 14 children with TBI who ranged from 7 to 13. Injury severity using the Glasgow Coma Scale (Teasdale & Jennett, 1974) was available for only 12 of the 14 TBI participants. Five children had severe TBI, 6 had moderate TBI, and 1 had mild TBI. For the two missing data points information from the parents regarding the injury and hospital procedures and scans were used, and indicated severe TBI. An aged matched non-injured control group ($n = 14$) was used for comparison purposes. The authors hypothesized the TBI group would report lower friendship quality and more loneliness compared to controls. It was also hypothesized parents of children with TBI would report their children as having lower levels of friendship quality, and lower levels of psychosocial functioning with peers.

Friendship quality was assessed using the Friendship Quality Questionnaire (FQQ; Parker & Asher, 1993), Loneliness assessed with the Loneliness and Social Dissatisfaction Scale (LSDS; Asher & Wheeler, 1985) and psychosocial functioning was assessed using both the Personality Inventory for Children – 2nd Edition (PIC-2; Wirt, Lachar, Klinedinst, & Seat, 1990) and the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1999).

Similar to findings by Bohnert and colleagues (1997), no differences between groups were found on children's report of friendship quality or parent report of their children's friendship quality. Additionally, no group differences were found on reported loneliness. Compared to their non-injured peers, children with TBI were reported as being more hyperactive and having more emotional and attentional problems. The findings from Ross et al. (2011) are useful in adding to the literature regarding the friendships of children with TBI, especially considering findings run

contrary to hypotheses expecting low levels of friendship quality. However, one major limitation that has recently been addressed is that friendship quality was only reported on by the child with TBI or the non-injured control. The friends' perception of the nature of the friendship was not taken into account, which is a critical point of view in assessing the overall quality of any relationship (Rubin, Bukowski, & Bowker, 2015).

Yeates et al. (2013) examined peer relationships and friendships of children with TBI and children with OI within the classroom. The authors' were interested to see if differences in peer relationships were associated with white matter measurement volumes.

TBI and OI participants were drawn from the larger SOBIK study that Moran and colleagues (2015) and the current dissertation utilized. The TBI group was divided by injury severity into two groups: mild/moderate ($n = 40$) and severe ($n = 15$). The OI group was comprised of 32 participants. The average age of TBI participants at the time of assessment was 10.1 years, and for OI participants 10.5 years. All participants completed a measure assessing their peers' social behaviors (Extended Class Play, Masten, Morison, & Pellegrini, 1985), a measure of peer acceptance (Peer Acceptance Ratings, Asher, Singleton, Tinsley, & Hymel, 1979), and best friend nominations. For the best friend nominations students nominated three of their best friends from their class, and scores were computed based on reciprocity of nominations and total friendship nominations (Bukowski & Hoza, 1989).

Relevant to the current dissertation, results of the Yeates et al. (2013) study found children with severe TBI to have the most social dysfunction. Children with

severe TBI were more likely to be rejected and victimized by their peers. Less than 50% of children with severe TBI had a mutual friend in their classroom, compared to the 90% of mild/moderate children with TBI. Children with TBI who did not report friends were rated by their peers as being less prosocial, less popular, and more rejected and victimized.

As a group, children with TBI did not differ from children with OI in peer reports of popularity, aggressive behavior or prosociality. Findings indicated children with severe TBI experienced the most social difficulties. Children with severe TBI who did not have reciprocal friend nominations were rated as being more problematic on all dimensions of social behavior compared to children who had mutual friends. The study (Yeates et al., 2013) provided novel information regarding how peers perceive children with TBI, as well as useful findings regarding the nature of friendships and peer relationships within the *classroom* for children with TBI.

Heverly-Fitt and colleagues (2014) explored friendship quality and psychosocial outcomes among children with TBI and OI. Specifically, the authors were interested in how the friends of children with TBI perceived their friendship quality, and whether or not friendship quality had any mitigating effects for outcomes related to emotional and behavioral problems. The sample of TBI and OI participants who completed measures of friendship quality in the Heverly-Fitt et al. (2014) study were the same participants used in the current dissertation study.

The average age for the entire sample was 10.4 years, and included 41 children with TBI and 43 children with OI. All participants and their best friends

completed a questionnaire assessing friendship quality (Network of Relationship Inventory; Furman & Buhrmester, 1985). Peer reports of victimization and rejection were collected in each participant's classroom (Extended Class Play; Rubin et al., 2006). Further, both parents and teachers completed reports related to social and behavioral adjustment (BASC-2; Reynolds & Kamphaus, 1992; and T-CRS; Hightower et al., 1986, respectively).

Results showed that children with TBI and their best friends reported their relationship similarly on dimensions of positive and negative friendship quality. This similarity indicates that children with TBI were not over- or under-estimating their friendship quality. Additionally, children with TBI reported more support and satisfaction with their friends compared to the OI group. For children with TBI who were rejected, positive perceptions of friendship buffered against maladaptive psychosocial outcomes (e.g. externalizing problems, behavioral symptoms). Further, for children with TBI who were rejected, positive perceptions of friendship support and satisfaction were associated with higher teacher ratings of peer social skills (Heverly-Fitt et al., 2014). These findings mirror existing literature in non-injured populations that have examined the protective nature of friendship support against maladaptive psychosocial outcomes (Malcolm, Jensen-Campbell, Rex-Lear, & Waldrip, 2006; Hodges et al., 1999).

As researchers are beginning to better understand and characterize the friendships of children with TBI, the next step should be to analyze associations between friendship and other socio-cognitive processes, such as SPS. It appears that, when children with TBI have mutual friendships, those relationships mirror those

found in normative populations in terms of friendship quality ratings. A clear next step is to examine whether SPS is influenced by friendship quality. This information would contribute to the effort to gain a more comprehensive picture of social outcomes for children with TBI, which in turn can help inform future interventions.

VI. Conclusions, Specific Aims, Hypotheses

In this review, various conceptual and theoretical foundations of SPS have been explored. It is clear that children's social interactions and relationships play a critical role in regard to SPS. Various assessments of SPS in children include Likert scales, hypothetical social dilemma interviews, and observational methodologies involving naturalistic settings and coding schemes. Due to their unwieldy nature, observational methodologies tend to be used least often; however they offer a valuable, nuanced, realistic look at SPS behaviors. Further, observational methodologies are rarely used in non-normative samples, such as with clinical samples of children who are at risk for socio-cognitive and emotional disruptions.

The importance of the identity of one's social partner during a social dilemma has been outlined. Children respond differently in problem situations to adults, unfamiliar peers, familiar peers, and friends (Stewart & Rubin, 1995; Strough, Berg, & Meegan, 2001; Warden & MacKinnon, 2003). Friends are more likely to choose strategies that will preserve their relationship in the long term (Laursen & Pursell, 2009). The SPS of a friendship dyad may also differ based on the overall friendship quality. For example, children whose friendships are characterized by conflict rather than mutual understanding and affection may utilize different SPS strategies to resolve their interpersonal problems (Rose & Asher, 1999). Exact associations

between friendship *quality* and SPS have not been extensively studied in normative populations, and especially not in clinical populations that are at-risk for social dysfunction.

Researchers have begun to explore how traumatic brain injury incurred during childhood may impact SPS (Hanten et al., 2008; Janusz et al., 2002; Yeates et al., 2004). Methodologically, hypothetical situation assessments have been heavily utilized to assess the various steps involved in SPS. What is less clear is how the SPS of children with TBI is influenced by friendship. Additionally, researchers have not used observational assessments with this population to capture the in-vivo problem solving in the company of a friend. It is clear that using such a methodology would provide a novel and valuable lens into the SPS behaviors and social competencies of children with TBI. This dissertation aims to explore these research gaps by applying an adapted observational SPS coding scheme to friendship dyads for a TBI group, OI group, and typically developing non-injured group, as they work together to problem solve.

Aim 1: Observed SPS between best friend dyads. Observational assessments have been useful in characterizing the SPS behaviors of young children with their peers, but not many studies have used similar methodology to observe the SPS behaviors of older children when interacting with their friends. The first aim of this study was to utilize an adapted observational coding scheme of SPS behaviors with best friend dyads.

Aim 2: Group differences in observed SPS amongst best friend dyads. Empirical literature suggests that children who have experienced a TBI demonstrate

SPS deficits (Hanten et al., 2008; Janusz et al., 2002; Muscara, Catroppa, Eren, & Anderson, 2009). These deficits have been found to be specific to the generation of lower level and preference for avoidant SPS strategies when compared to children with OI (Janusz et al. 2002; Moran et al., 2015). The second aim of this study was to explore potential group differences in observed SPS amongst children with TBI, children with OI, and typically developing non-injured children. It was hypothesized that the TBI dyads would demonstrate less adaptive SPS compared to the OI and non-injured dyads. Specifically, it was expected the TBI dyads would experience fewer SPS successes, more SPS failures, and would demonstrate fewer direct strategies (e.g. commands, didactic, explanation of consequences) and more avoidant strategies (e.g. indirect requests and questions) in comparison to the OI and non-injured dyads.

Aim 3: Impact of friendship quality on observed SPS (Figure 2).

Theoretically and empirically, there is evidence in typically developing children to suggest that friendship and SPS influence one another (Hinde, 1987; Newcomb & Brady, 1982; Strough, Berg, & Meegan, 2001). However, little empirical data exists that examines the associations between friendship *quality* and SPS, especially in children with TBI. The third aim of this study was to examine the potential moderating effect of friendship quality on the association between group type (TBI, OI, or typically developing non-injured) and SPS. The hypothesis for the third aim was that friendship quality would moderate the relation between group type and SPS behaviors. Friendships characterized as positive and satisfactory would be associated with more SPS successes, fewer failures, and use of more direct strategies (commands, didactic). A secondary hypothesis was that friendships characterized as

highly negative would be associated with more maladaptive SPS behaviors and outcomes. Specifically, this means fewer successes, increased failures, fewer direct strategies (commands, didactic), and increased production of avoidant strategies (questions, indirect requests).

Chapter 3: Methods

I. TBI and OI Participants

Participants from the TBI and OI groups were drawn from the Social Outcomes in Brain Injured Kids (*SOBIK*; funding provided to Keith O. Yeates by the NICHD: R01HD048946) project, a multi-level, multi-site study of social and social-cognitive outcomes following childhood traumatic brain injuries. One of the main aims of the *SOBIK* study was to better characterize the social interactions and social adjustment of children with TBI. Participants ($N = 143$) were recruited from children's hospitals at three metropolitan sites, including the Hospital for Sick Children in Toronto (Canada), Nationwide Children's Hospital in Columbus (US), and Rainbow Babies and Children's Hospital and MetroHealth Medical Center in Cleveland (US). The data were obtained in compliance with formal ethics review committees at the participating institutions. Both parent consent and child assent were obtained prior to testing.

Eligible participants included children hospitalized for either a traumatic brain injury (TBI) or orthopedic injury (OI), who were from 8 to 13 years of age at the time of their participation and who were injured between 12 and 63 months prior to participation. Researchers often use children with OI, such as a broken bone, as a comparison group for children with TBI because both groups experience trauma and hospitalization, and have similar premorbid functioning and background demographics (Janusz, et al., 2002; Yeates et al., 2013). The OI comparison group was matched to the TBI sample by age and sex.

The current study comprised a reduced sample from the larger SOBIK project of 84 best friend dyads (TBI = 41; OI = 43). Of the entire TBI and OI sample ($N = 143$), 100 completed the second laboratory visit. Of those 100 children, 16 completed only questionnaires at the second laboratory visit. The remaining 84 completed the questionnaires and were observed with their best friend during the second laboratory visit (see below for further description). Of the 41 TBI dyads, 25 were male. Of the 43 OI dyads, 27 were male. The TBI severity breakdown was assessed using the Glasgow Coma Scale (Teasdale & Jennett, 1974) included 10 severe TBI participants, 8 moderate TBI participants, and 23 complicated mild TBI participants.

Injury mechanism was divided into three categories: fall, motor vehicle accident, and bike/sports/recreational accident. For TBI participants, 42% were injured via a sport or bike injury, 29% were injured in a fall, and the remaining 29% were injured in a motor vehicle accident. For OI participants, 72% were injured via a sports/bike accident, 28% in a fall, and 2% in a motor vehicle accident. Other sample demographics are included in Table 1.

The average age of the TBI participants was 10.8 years, and the average age of their best friends was 11.4 years. Group differences were found for TBI participants who completed the best friend measures and those TBI participants who either did not complete the second laboratory visit or did not complete the best friend measures on demographic variables of IQ, SES, age at injury, and age at assessment (Table 2). TBI participants who had a best friend present during the second laboratory visit had higher IQ scores compared to TBI participants who did not complete the second laboratory visit best friend measures. However, means of IQ for both groups

were, on average, within the normative-to-high range. TBI participants with a best friend were on average a year older at both the time of injury and time of testing compared to TBI participants who did not bring a best friend to the second session.

The average ages of OI participants and their best friends were 10.6 years and 10.8 years, respectively. Children with OI from the larger study who did not complete the second laboratory best friend measures did not significantly differ from children with OI who did complete the best friend measures during the second laboratory visit on any demographic or behavioral variables (Table 3).

Children with TBI were eligible for participation if they were diagnosed with complicated mild to severe TBI via the Glasgow Coma Scale (GCS; Teasdale & Jennett, 1974). Severe TBI was defined based on a lowest post-resuscitation GCS score of 8 or less; moderate TBI was based on a GCS score from 9 to 12; and complicated mild TBI was based on a GCS score of 13 to 15 in association with trauma-related abnormalities on neuroimaging at the time of hospitalization.

The OI group comprised children who had sustained fractures that involved hospital admission but were not associated with any loss of consciousness or other risks or indications of brain injury (e.g., skull or facial fractures). Parents of OI youth were asked about the nature of the child's injury and other demographic variables.

Eligible children with TBI and with OI had the following additional exclusion criteria applied: (a) history of more than one serious injury requiring medical treatment; (b) premorbid neurological disorder or mental retardation; (c) any injury resulting from child abuse or assault; (d) a history of severe psychiatric disorder requiring hospitalization prior to the injury; (e) sensory or motor

impairment that prevented valid administration of study measures; (f) primary language other than English; and (g) medical contraindication to MRI or behavioral study. Children in full-time special education classrooms were excluded because the reliability and validity of peer data for such classrooms have not been established.

TBI and OI Participant Procedure. Following recruitment from the hospitals, two separate laboratory visits occurred. During the first laboratory visit, children with TBI and children with OI completed their friendship nominations. Nominated best friends who had not sustained a TBI or OI were then recruited based on contact information provided by parents participating in the study. Best friends who agreed to participate were asked to attend the second laboratory visit with their friend who had sustained a TBI or OI. The most common reasons for not completing the laboratory visit with a friend were either due to contact issues with the target TBI or OI child (e.g. unable to schedule visit) or due to the target child/family declining the subsequent laboratory visit.

During the second laboratory visit, children with TBI, children with OI, and the best friend nominated during the initial laboratory visit provided information about the quality of their friendship. Each TBI and OI best friend dyad was videotaped as the children completed a three-part structured 30 minute observational protocol in a large laboratory setting. Best friend dyads first were given 10 minutes for free play in a room consisting of age appropriate toys. Following the free play session, best friend dyads were asked to plan a weekend together, with no monetary restrictions (10 minutes). Lastly, each best friend dyad participated in a paper folding

task (origami; Appendix C). Participants were seated at a table, and three origami models ranging from easy to difficult were placed in front of them, along with instructions for each of the figures and unused sheets of paper. Each dyad was instructed by a research assistant to *work together* to replicate the origami models. There was no order in which the dyad had to complete the figures, and the children were told if they finished one figure they should start on another figure together. After the research assistant provided the instructions, she left the room and the dyad was left to work together for ten minutes. For the purposes of the current study, only the origami task was coded for social problem solving behaviors.

II. Typically Developing Non-injured Participants

Non-injured participants were matched by age and sex from a larger longitudinal study that aimed to examine psychological adjustment in the context of the transition to middle school (*The Friendship Project*; funding provided to Kenneth H. Rubin by the NIMH: MH58116). The larger Friendship Project sample included 856 5th grade participants recruited from eight public elementary schools and 1331 6th grade participants recruited from three public middle schools in the greater Washington D.C. metropolitan area. Both parent consent (consent rate 84%) and child assent were obtained prior to any data collection.

To avoid overlapping data, participants with data from both the 5th grade and 6th grade time points were randomly selected to be included in either 5th grade or 6th grade. Additionally, peer reports of social behavior were collected in the larger Friendship Project. Participants were excluded from the current dissertation study if they were identified as extremely aggressive, extremely shy/withdrawn, or as both

extremely aggressive and shy/withdrawn. Extreme groups were identified by *high* peer ratings of non-normative behaviors (e.g. in the top 33% for ratings of aggression and shyness/withdrawal) and *low* peer ratings of normative behaviors (e.g. bottom 50% in peer ratings of sociability and prosociality). The current study included a non-injured sample that comprised 41 best friend dyads (25 male) that matched the TBI dyads by age and sex.

Typically Developing Non-injured Procedure. Classroom data for *The Friendship Project* were collected during the fall (November-December) and spring (April-May) semesters of both 5th and 6th grade. Participants completed a battery of questionnaires, including the friendship nomination questionnaire. Following identification of each participant's best friend, a laboratory visit occurred. During the laboratory visit, best friend dyads were asked to complete a questionnaire assessing their friendship quality. Fifth and 6th grade best friend dyads were invited to participate in an observational session that was structured similarly to that described above vis-à-vis the TBI and OI participants.

Both 5th and 6th grade best friend dyads first engaged in 10 minutes of unstructured free play. Both 5th and 6th grade dyads then discussed their best times spent together (5 minutes), discussed a moral dilemma (10 minutes), and completed either an origami or knot tying task (10 minutes). Fifth grade best friend dyads completed the same origami procedure that both TBI and OI best friend dyads completed; 6th grade best friend dyads engaged in a similar problem solving task that involved knot tying with ropes (Appendix D). Similar to the origami task, the 6th grade best friend dyads sat at a table with three different ropes tied in knots varying

from easy to difficult to replicate. As in the origami task, the dyad was instructed to work together to replicate the knots. There was no order in which the dyad had to complete the knots, and they were told if they finished one knot they should move on to another. Lastly, both 5th and 6th grade dyads spent 10 minutes planning a weekend together. For the purposes of the current study, only observational data from the problem solving tasks was utilized since that session most closely related to the scope of the coding scheme.

III. Measures

Friendship nominations (Appendix E). All three groups (TBI, OI, and typically developing non-injured) completed a friendship nomination measure (Bukowski, Hoza, & Boivin, 1994) in order to identify the best friend dyads. The TBI and OI participants were instructed to nominate three same-sex and same-age best friends. Nominated best friends who had not sustained a TBI or OI were subsequently contacted. Participant data were excluded if they nominated a family member as their only best friend ($n = 1$). For the non-injured group, participants were instructed to nominate their first and second same-sex best friend within their grade. Best friend dyads for the non-injured group consisted of participants who nominated each other as their first or second best friend.

Friendship quality (Appendix F). All three groups (TBI group, OI group, non-injured group) along with their best friends completed the Network of Relationships Inventory (*NRI*; Furman & Buhrmester, 1985) to assess perceived levels of social support, negative interactions, and satisfaction within their friendships. Participants rated items on a scale of 1 ('little or none') to 5 ('the most').

The friendship support factor included a mean score across 24 items that describe admiration (e.g. How much does this person treat you like you're admired and respected?), affection (e.g. How much does this person like or love you?), companionship (e.g. How often do you go places and do enjoyable things with this person?), instrumental aid (e.g. How much does this person teach you how to do things that you don't know?), intimacy (e.g. How much do you tell this person everything?), nurturance (e.g. How much does this person take care of you?), and reliable alliance (e.g. How sure are you that your relationship will last in spite of fights?). Item scores were averaged with higher scores indicating more positive perceptions of friendship support. Friendship negativity included a mean score across 9 items that described conflict (e.g. How much do you and this person get upset with or mad at each other?), and punishment (e.g. How much does this person punish you?). Higher scores were indicative of greater negativity within the dyad. Friendship satisfaction included a mean score of 3 items that described a child's enjoyment in their friendship (e.g. How satisfied are you with your relationship with this person?). Higher scores indicated greater friendship satisfaction. Descriptive means and standard deviations for each of the three friendship quality factors are provided in Table 4 for each group.

Observational coding of social problem solving (Appendix G, Examples Appendix H). Observational coding was adapted from a social problem solving protocol used previously with children from preschool to Grade 4 (Rose-Krasnor & Rubin, 1983; Stewart & Rubin, 1995).

Dyadic social problem exchanges included an *initiator* and *target*. The *initiator* started a coding event by indicating some goal they wished to achieve. The *target* referred to the other social partner in the dyad. Two criteria were outlined prior to coding any dyadic interaction: 1) the initiator socially engages their friend in a manner that relates to the task; 2) this initiation is verbal. Coding was first organized into two broad categories: time spent on-task and time spent off-task. On-task behaviors occurred when the dyad was actively working *together* on the SPS task at hand. When the dyad was on-task, the SPS coding involved three separate subcategories: SPS goals, SPS strategies, and SPS outcomes. Examples of off-task behaviors included: play, working *separately* on the SPS task, and simply not engaging in the task at all. Off-task behaviors were *not* coded for SPS goals, SPS strategies, or SPS outcomes.

SPS Goals. Socially directed goals included: 1) *information seeking* – an attempt was made to obtain information for help; 2) *object acquisition* – an attempt was made to acquire an object from the target; 3) *stopping an action* – an attempt was made to stop or prevent an action; 4) *modifying an action* – an attempt was made to change the target’s behavior; 5) *attention seeking* – an attempt was made to draw the target’s attention to a specific object (e.g., the instructions to the task); 6) *redirect* – an attempt was made to redirect the target back to the task. All goals were mutually exclusive.

SPS Strategies. Social strategies included: 1) *commands* – direct imperatives (i.e. “let me see that”); 2) *indirect requests* – (i.e. “try folding the other flap over first”); 3) *didactic* – verbal comments outlining instructions (i.e. “see now these two

folds go down”); 4) *question* – question elicited to gather information (“how does this fold go?”); 5) *explanation of consequences* – attempt to future orient a current behavior (i.e. “if you do that there will be an extra knot”); 6) *aggressive*– forceful act directed at the target (i.e. aggressively grabbing an object); 7) *orienting* – includes gestures such as pointing; 8) *grab* – non-forceful or non-aggressive grab for an object.

Direct strategies are those that involved degrees of assertiveness, and include commands, didactic, and explanation of consequences. Avoidant strategies were passive in nature and include indirect requests and questions.

All strategies were considered mutually exclusive except for aggressive, orienting, and grabs. For example, while giving a command the initiator may point to the instructions. This would be double coded as a command and orientation. Another example is: if the initiator’s SPS goal was object acquisition, they may ask for the object while simultaneously forcibly taking the object out of the target’s hand. This would include a double code of both a question and aggressive.

SPS Outcomes. Outcomes for an initiator’s social problem solving strategy included successful, partial success, or failures.

Successful. The target complies within 5 seconds.

Partial success. Partial successes included clarification, acknowledgement, or partial compliance on the target’s part. *Requests for clarification* involved the target replying, but for clarification purposes (i.e. “what?”). *Acknowledgements* occurred when the target acknowledged the initiator but failed to perform the solicited action. Lastly, *partial compliance* involved the target complying with only part of the initial action, such as with a negotiation.

Failure. Failures involved instances where the target either offered no response or refused the initiator.

Codes following failure. If the initiator's first strategy resulted in a failure, follow-up codes were applied: 1) *rigid* – the follow-up strategy was exactly the same as the first; 2) *modified* – the original strategy was modified; 3) *self-solution* – initiator addressed the first request on their own; 4) *clarification* – the initiator further clarified their initial response; 5) *no attempt* – the initiator made no further attempts

IV. Initial Coding Training

All videos were coded using the Noldus Observer XT software. Noldus Observer XT was also used for all reliability analyses. Three undergraduate research assistants first attended a training session that reviewed each of the SPS codes in detail. During this first session, coders were told the scope of the study was focused only on SPS behaviors and friendship, with no mention of TBI or OI injury status. Twelve training tapes were used to assess reliability. Each week, research assistants were given two training videos to code. All training videos had a master copy coded by the author of this proposal, which were used to check for discrepancies. After the first week of coding two training tapes, a second group meeting was held to discuss common discrepancies between the research assistants' SPS coding and the master copies. Research assistants continued to code the remaining ten training tapes and individual meetings were held as needed to discuss frequent discrepancies with the master copies. Coders were considered reliable after achieving Cohen's kappa of at least .70 on eight out of the ten training tapes. One coder was unable to reliably

produce Cohen's kappa of .70 on eight of the tapes and was not involved in any further coding.

Coding Reliability. Inter-observer reliability was based on 20% of double-coded data (25 of the 125 videos). Inter-observer agreement was calculated using Cohen's kappa for SPS goals ($\kappa = 0.84$), strategies ($\kappa = 0.83$), outcomes ($\kappa = 0.88$), follow-up after failure, ($\kappa = 0.79$) and partial successes ($\kappa = 0.76$). The reported Cohen's kappas were comparable to studies using the original coding scheme (Rose-Krasnor & Rubin, 1983; Stewart & Rubin, 1995). When using observational data Cohen's kappa has been described as an appropriate method for assessing reliability (Bakeman & Gottman, 1997).

Data Preparation. SPS goals, strategies, and outcomes were proportionalized. Logit transformations were then performed on these proportionalized scores for SPS goals, strategies, and outcomes. This procedure has been used previously with an earlier version of the SPS coding scheme (Stewart & Rubin, 1995).

V. Data Analysis

Aim 1: Observed SPS between best friend dyads. Descriptive statistics (means, standard deviations, frequencies) were calculated for observed on-task social problem solving goals, strategies, outcomes, and failure follow-ups within each best friend dyad for all groups.

Aim 2: Group differences in observed SPS amongst best friend dyads. MANOVAs and ANOVAs were conducted to assess group differences in SPS outcomes (successes and failures), direct strategies (commands, didactic and

explanation of consequences) and avoidant strategies (indirect requests and questions) between the TBI group, OI group, and the non-injured group friendship dyads. Injury group served as the between-subject factor.

Aim 3: Impact of friendship quality on observed SPS. Moderation analyses were conducted to examine the effect of friendship quality on the relation between group membership and SPS. Analyses were conducted using the PROCESS Macro add-on to SPSS (Hayes, 2013). For the moderating variables, positive, negative, and satisfactory dimensions of friendship quality were centered. The interaction term was the product of group membership and each of the three centered dimensions of friendship quality (positive, negative, and satisfactory).

Prior to running moderation analyses, the association between the three dimensions of friendship quality and SPS were examined. The three dimensions of friendship quality refer to positive friendship quality, negative friendship quality and satisfaction within the friendship. SPS outcomes (successes and failures), direct strategies (commands, didactic and explanation of consequences), and avoidant strategies (indirect requests and questions) were the dependent variables and were based on the logit transformations discussed in the data preparation section. The association between the *interaction* of group type and friendship quality with SPS outcomes, direct strategies, and avoidant strategies were also examined.

The moderation analyses examined the influence of the three dimensions of friendship quality on the relation between group type and SPS. For *each* SPS outcome, three moderation analyses were conducted. Similarly, for *each* SPS direct strategy three moderation analyses were conducted. For *each* SPS avoidant strategy

three moderation analyses were conducted. In total, 18 moderation analyses were conducted.

Chapter 4: Results

I. Aim 1: Utilizing an Adapted Observational Coding Scheme of SPS Behaviors

Descriptive statistics revealed that all types of SPS goals, strategies, outcomes and follow-ups after failure were observable in the interactions between the best friend dyads.

SPS Goals (Table 5). TBI dyads exhibited, on average, 4.49 ($SD = 3.42$) attention seeking goals, 6.85 ($SD = 4.69$) modifying an action goals, 3.95 ($SD = 2.36$) information goals, 1.78 ($SD = 1.72$) stopping an action goals, 1.22 ($SD = 1.57$) object acquisition goals, and 0.22 ($SD = 0.61$) redirection goals.

OI dyads produced on average 4.76 ($SD = 3.51$) attention seeking goals, 8.69 ($SD = 5.23$) modifying an action goals, 4.10 ($SD = 2.77$) information goals, 2.43 ($SD = 2.43$) stopping an action goals, 1.86 ($SD = 2.05$) object acquisition goals, and 0.24 ($SD = 0.87$) redirection goals. On average, non-injured dyads produced 6.80 ($SD = 3.53$) attention seeking goals, 9.37 ($SD = 6.48$) modifying an action goals, 4.07 ($SD = 2.82$) information goals, 1.27 ($SD = 1.61$) stopping an action goals, 1.46 ($SD = 1.69$) object acquisition goals, and 0.07 ($SD = 0.34$) redirection goals.

SPS Direct strategies (Table 6). TBI dyads produced, on average, 5.29 ($SD = 3.29$) commands, 7.10 ($SD = 4.76$) didactic, and 0.51 ($SD = .87$) explanation of consequences. In comparison, OI dyads exhibited on average 7.38 ($SD = 4.75$) commands, 7.88 ($SD = 4.34$) didactic, and 0.64 ($SD = .98$) explanation of consequences. Additionally, non-injured dyads exhibited on average 7.46 ($SD = 3.37$) commands, 9.56 ($SD = 7.10$) didactic, and 0.73 ($SD = 1.18$) explanation of consequences.

SPS Avoidant strategies (Table 7). TBI dyads produced 4.24 ($SD = 2.63$) questions and 1.34 ($SD = 1.57$) indirect requests on average. OI dyads produced 4.95 ($SD = 3.18$) questions and 1.33 ($SD = 1.64$) indirect requests on average. Non-injured dyads exhibited, on average, 4.27 ($SD = 2.92$) questions and 0.76 ($SD = 1.26$) indirect requests. Frequency statistics, means, and standard deviations for each SPS goal, strategy, outcome, and follow-up after failure are provided for each group in Tables 4-7.

SPS Outcomes (Table 8). On average, children with TBI and their best friends produced 12.95 ($SD = 6.94$) SPS successes and 3.22 ($SD = 2.66$) SPS failures. Comparatively, children with OI and their best friends had, on average, 16.21 ($SD = 8.37$) SPS successes and 3.55 ($SD = 2.7$) SPS failures. Non-injured children and their best friends had on average 17.76 ($SD = 8.58$) SPS successes and 3.32 ($SD = 2.37$) SPS failures. Follow-up to failures are presented in table 7. An additional calculation of the persistence index was calculated to determine how likely a re-attempt followed a failed attempt. This procedure was previously conducted by Rose-Krasnor and Rubin (1983). The persistence index was calculated by summing all of the failure follow-ups with the exception of no attempt. The total number of failed attempts then divided by this value. A persistence index of 100% would indicate every time a failed outcome occurred a re-attempt was made.

Due to the low frequency of follow-up to failures and partial successes, those SPS behaviors were not included in further analyses. As a result, analyses involving SPS outcomes examined only successes and failures. In addition, explanation of consequences was removed from any analyses involving direct strategies due to low

frequencies across all groups. Thus, all subsequent analyses involving direct strategies will only refer to commands and didactic behaviors.

II. Aim 2: Group Differences in Observed SPS between Best Friend Dyads

SPS Goals. For attention seeking, the assumption for normality was met using the Shapiro-Wilks test for the TBI ($p = .67$) and OI ($p = .30$) groups. The non-injured group did not meet the Shapiro-Wilks normality assumption ($p < .001$).

SPS Direct Strategies. The hypothesis was that the TBI group would produce fewer direct strategies (commands and didactic) when compared to both the OI and non-injured group. Commands and didactic were moderately negatively correlated at -0.39 . The normality assumption was met for commands with the Shapiro-Wilks test for the TBI ($p = .13$) and OI ($p = .46$) groups. The non-injured group did not meet the Shapiro-Wilks normality assumption ($p = .002$). The TBI group met the normality assumption for didactic using the Shapiro-Wilks test ($p = .68$). Both the OI and non-injured group violated the normality assumption of the Shapiro-Wilks test ($p = .02$ and $p = .03$, respectively). *Box's M* was not violated (2.64), $p (.85) > \alpha .001$, indicating that there were no significant difference among the covariance matrices. Two univariate ANOVAs were run due to the multiple violations of normality assumption. Alpha was adjusted to $.01$ to compensate for the running of multiple tests

No group differences were found for the production of didactic strategies $F(2,119) = .32, p > .01, n^2 = .01$. Group differences were found for commands $F(2, 118) = 3.39, p = .01, n^2 = .05$. *Post hoc* Tukey HSD revealed differences in command production between the TBI group ($M = -1.48$) and non-injured group ($M = -1.06$; $p = .03$). Since the means are based on logit transformed values, the non-injured group

produced *more* commands compared to the TBI group. This partially supports the hypothesis that TBI dyads would produce fewer didactic and fewer commands compared to the OI and non-injured groups.

SPS Avoidant Strategies. The initial hypothesis was that the TBI group would produce more avoidant strategies (questions and indirect requests) compared to the OI and non-injured group. Questions and indirect requests were not correlated at 0.01. For the SPS strategy questions, all three groups met the normality assumption using the Shapiro-Wilks test (TBI: $p = .24$; OI: $p = .82$; non-injured: $p = .72$). Both TBI and OI groups met the normality assumption for the SPS strategy indirect requests ($p = .72$ and $p = .29$, respectively). The non-injured group violated the normality assumption for the SPS strategy indirect request when using the Shapiro-Wilks test ($p = .04$). Due to this normality assumption violation, the low frequency in production of indirect requests, and the lack of correlation between the dependent variables, two univariate ANOVAs were run to assess group differences between questions and indirect requests. An adjusted alpha of .01 was used due to the multiple running of tests.

No group differences were found for production of questions $F(2, 115) = 1.11$; $p = .33$; $n^2 = .02$. Similarly, no group differences were found for the production of indirect requests $F(2, 67) = 0.68$; $p = .50$; $n^2 = .02$. These results do not support the hypothesis that the TBI group would demonstrate more avoidant strategies compared to the OI and non-injured groups.

SPS Outcomes. The initial hypothesis was that the TBI group would exhibit fewer successes compared to the OI and non-injured group. Successes and failures

were significantly negatively correlated at -0.75. For successes, the assumption for normality was met using the Shapiro-Wilks test for all three groups (TBI: $p = .93$; OI: $p = .93$; Non-Injured: $p = .42$). All three groups also met the normality assumption for failures using the Shapiro-Wilks test (TBI: $p = .16$; OI: $p = .29$; Non-Injured: $p = .75$). Box's Test of Equality of Covariance Matrices was used to assess homogeneity of covariance across all groups. *Box's M* was not violated (3.17), $p (.79) > \alpha .001$, indicating that there were no significant difference among the covariance matrices.

A MANOVA was run using injury group as the between subjects factor and SPS successes and SPS failures as the dependent variables. No statistically significant group differences were found for SPS successes or failures $F(4, 218) = 1.18$; $p = .32$; Wilks' $\lambda = 0.95$, $\eta^2 = .02$. This result does not support the hypothesis that the TBI group would produce fewer successes compared to the OI and non-injured groups.

III. Aim 3: Impact of Friendship Quality on Observed SPS

The initial hypothesis was that friendship quality would moderate the relation between group type and SPS behaviors. Friendships characterized as positive and satisfactory would be associated with more SPS successes, fewer failures, and use of more direct strategies (commands, didactic). A secondary hypothesis was that friendships characterized as highly negative would be associated with more maladaptive SPS behaviors and outcomes. Specifically, this means fewer successes, increased failures, fewer direct strategies (commands, didactic), and increased production of avoidant strategies (questions, indirect requests).

The independent variable for the moderation analyses was injury group type which was dummy coded with the TBI group serving as the referent group. The

moderator variables included three dimensions of friendship quality, positive, negative and satisfaction. Lastly, the dependent variables included SPS outcomes (successes and failures), SPS direct strategies (commands and didactic), and SPS avoidant strategies (questions and indirect requests). The interaction terms referred to the product of the injury group and each of the three dimensions of friendship quality.

All analyses were conducted using the PROCESS macro add-on in SPSS, version 2.15 (Hayes, 2013). All three dimensions of friendship quality (the moderator) were mean centered and all analyses used Model one provided by the PROCESS package, which is equivalent to testing the moderation model provided in Figure 2.

Prior to running moderation analyses, correlations were run between the moderator variables and dependent variables. No correlations between the three moderator variables and the six dependent variables were significant (Table 9). Correlations were then run between the interaction (between group type and each moderator) and the dependent variables. No correlations were significant (Tables 10 and 11). In order to completely fulfill testing the hypotheses related to Aim Three, moderations were run despite lack of correlations among the variables.

SPS Direct Strategies. The initial hypothesis was that friendships characterized as positive and satisfactory would result in use of more commands and didactic strategies. Conversely, friendships characterized as highly negative were hypothesized to result in fewer commands and didactic strategies. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and the SPS direct strategies commands and didactic.

SPS commands. Positive friendship quality was not a significant moderator between group type and SPS commands $F(5, 115) = 1.35, p = 0.24, R^2 = .03$. Negative friendship quality was not a significant moderator for the relation between group type and commands $F(5, 115) = 1.61, p = 0.16, R^2 = .09$. Satisfaction was not a significant moderator for the relation between group type and commands $F(5, 115) = 1.41, p = 0.22, R^2 = .08$.

SPS didactic. Positive friendship quality was not a significant moderator between group type and didactic $F(5, 116) = 1.11, p = 0.35, R^2 = .03$. Negative friendship quality was not a significant moderator for the relation between group type and didactic $F(5, 116) = 0.80, p = 0.54, R^2 = .03$. Satisfaction was not a significant moderator for the relation between group type and didactic $F(5, 116) = 1.13, p = 0.34, R^2 = .04$.

SPS Avoidant Strategies. The hypothesis was that friendships characterized as positive and satisfactory would result in production of *fewer* questions and indirect requests. Conversely, it was hypothesized that friendships characterized as highly negative would be associated with production of *more* questions and indirect requests. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and the SPS avoidant strategies questions and indirect requests.

SPS questions. Positive friendship quality was not a significant moderator between group type and questions $F(5, 112) = 1.12, p = 0.35, R^2 = .03$. Negative friendship quality was not a significant moderator for the relation between group type and questions $F(5, 112) = 0.64, p = 0.66, R^2 = .02$. Satisfaction was not a significant

moderator for the relation between group type and questions $F(5, 112) = 1.72, p = 0.13, R^2 = .05$.

SPS indirect requests. Positive friendship quality was not a significant moderator between group type and indirect requests $F(5, 64) = 0.69, p = 0.62, R^2 = .05$. Negative friendship quality was not a significant moderator for the relation between group type and indirect requests $F(5, 64) = 0.63, p = 0.67, R^2 = .03$. Satisfaction was not a significant moderator for the relation between group type and indirect requests $F(5, 64) = 0.68, p = 0.64, R^2 = .05$.

SPS Outcomes. The initial hypothesis was that friendships characterized as positive and satisfactory would result in more successes and fewer failures. Additionally, it was hypothesized that friendship characterized as highly negative would result in fewer successes and increases in failures. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and SPS successes and failures.

SPS successes. Positive friendship quality was not a significant moderator between group type and successes $F(5, 116) = 1.72, p = 0.13, R^2 = .05$. Negative friendship quality was not a significant moderator of the relation between group type and successes $F(5, 116) = 1.18, p = 0.32, R^2 = .04$. Satisfaction was not a significant moderator for the association between group type and successes $F(5, 116) = 1.92, p = 0.09, R^2 = .06$.

SPS failures. Positive friendship quality was not a significant moderator between group type and SPS failure $F(5, 107) = 0.33, p = 0.89, R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type

and failures $F(5, 107) = 0.45, p = 0.81, R^2 = .02$. Satisfaction was **not** a significant moderator for the relation between group type and failures $F(5, 107) = 0.39, p = 0.84, R^2 = .02$.

IV. Additional Analyses

Additional analyses were run in an effort to better understand the nature of the observational data. After revisiting the Rose-Krasnor and Rubin (1983) article, which used the original version of the adapted coding scheme, focus was placed on the SPS goals coded in the current study. Rose-Krasnor and Rubin (1983) grouped SPS goals into high cost and low cost categories. The authors' hypothesized that goals requiring less effort from the target would result in higher successes (low cost). Conversely, goals which required more effort from the target and which interrupted the target's current activity may be less likely to have a successful outcome (high cost). Using this template, in the current study low cost goals comprised attention seeking and information. High cost goals comprised modifying an action, stopping an action, and object acquisition. Much like the analyses examining group differences between use of direct and avoidant strategies, group differences between high cost and low cost goals were examined.

Low cost versus high cost goals. Prior to running analyses for group differences assumptions for normality, homogeneity of covariance, and multicollinearity were assessed for both the low cost and high cost goals.

Low cost goals. All groups met the normality assumption for each low cost goal. For attention seeking, the Shapiro-Wilks test was non-significant for the TBI ($p = .74$), OI ($p = .69$) and non-injured group ($p = .18$). For information, the Shapiro-

Wilks test was met by the TBI group ($p = .49$), OI group ($p = .13$) and non-injured group ($p = .87$). Bivariate correlations between attention seeking and information were not significant $r = .01$, $p = .95$. Due to the low correlation univariate ANOVA analyses were run separately to test for group differences in attention seeking and information. Attention seeking and information were the dependent variables and group type served as the independent variable.

Group differences were found for attention seeking goals $F(2, 115) = 5.59$, $p = .005$, $\eta^2 = .09$. *Post hoc* Tukey HSD revealed differences in attention seeking between the TBI group ($M = -1.23$) and non-injured group ($M = -.81$; $p = .01$), and between the OI group ($M = -1.35$) and non-injured group ($M = -.81$; $p = .002$). Since the means are based on logit transformed values, the non-injured group had *more* attention seeking goals compared to the TBI and OI group. No group differences were found for information seeking $F(2, 115) = 2.10$, $p = .13$ $\eta^2 = .03$.

High cost goals. All groups met the Shapiro-Wilks normality assumption for each of the high cost goals: modify an action (TBI: $p = .72$; OI: $p = .73$; non-injured: $p = .36$); stop an action (TBI: $p = .77$; OI: $p = .59$; non-injured: $p = .51$); and object acquisition (TBI: $p = .25$; OI: $p = .79$; non-injured: $p = .72$). Modifying an action and object acquisition were significantly correlated ($r = -.28$ $p < .05$). Modifying an action and stopping an action were not significantly correlated ($r = .01$ $p > .05$). Stopping an action and object acquisition were significantly correlated ($r = -.21$ $p < .05$).

A MANOVA was run using injury group as the between subjects factor and modifying an action, object acquisition, and stopping an action served as the

dependent variables. No statistically significant group differences were found between any of the high cost goals $F(6, 102) = 2.19; p = .32$; Wilks' $\lambda = 0.78$, $\eta^2 = .11$. This result suggests there were no group differences in the use of any of the high cost strategies.

Successful goal-strategy sequencing. Another addition to the analyses involved an exploratory analysis of the sequencing of successful goals and strategies. For example, how often is a command likely to follow a goal of object acquisition, and how likely is a success with this goal-strategy sequence? Frequency counts were calculated for each goal-strategy sequence. In order to reduce the number of permutations that could occur, only the mutually exclusive strategies were included in the goal-strategy sequencing. This means orienting, grabs, and aggressive codes were excluded. An example of a goal-strategy sequence would be an instance where an object was obtained after using a command (goal-strategy sequence: object acquisition-command). *Successful* goal-strategy frequencies and percentages are provided by group (TBI: Table 12; OI: Table 13; Non-injured: Table 14). Based on these frequencies, proportions comparing each group on successful high cost and low cost goals were calculated (Table 15). The OI group was equally successful for both high cost and low cost goals. Both the TBI and non-injured groups were more successful when attempting low cost goals. The TBI group had 60% success with high cost goals, whereas the OI group had 72% success and the non-injured group had 75% success. Statistical comparison of the TBI proportion of successes and non-injured proportion of successes did not reveal statistically significant group differences ($z = -1.45, p = 0.14$, two-tailed).

Participant group re-organization. In order to better understand the potential dynamics existing between the TBI injury severity groups, the participants were separated into a complicated mild *and* moderate TBI group and a severe TBI group. This breakdown of injury severity groups has been utilized in past studies in order to directly compare the outcomes as they differ by injury severity (Wolfe et al., 2014; Yeates et al., 2013). Additionally, for a large majority of the analyses, the OI and non-injured groups were combined into one control group.

It is important to note that the OI and non-injured participants were found to significantly differ when compared on the high cost goal of stopping an action $F(1,81) = 6.53, p > .05$ and on the low cost goal of attention seeking $F(1,81) = 6.99, p < .05$. Therefore, for all analyses involving these two dependent variables, the paired comparisons were conducted as follows: combined complicated mild/moderate TBI group versus OI group; severe TBI versus OI group.

Use of frequency scores. The log transformations based on the proportions of the SPS goals, strategies and outcomes may not have captured potential group differences in the raw frequencies of SPS behaviors. For example, a severe TBI dyad could have displayed a total of ten SPS strategies, six of which were commands. Likewise, a non-injured dyad could have displayed a total of one hundred SPS strategies, sixty of which were commands; yet both dyads would have a 60% proportion of command strategies accounted for despite the large difference in the actual frequency count. In order to better account for such possibilities, the ANOVA and moderation analyses were re-run using the frequency scores for all dyads.

Aim 2: Group Differences in Observed SPS between Best Friend Dyads

Complicated mild/moderate TBI compared to control group. Paired comparisons on each of the dependent variables were conducted between the combined complicated mild/moderate TBI group and the control group (combined OI and non-injured participants).

SPS high cost goals. No group differences were found for the high cost goals of modifying an action $F(1,112) = 2.88, p > .05$ or object acquisition $F(1,112) = 1.12, p > .05$.

SPS low cost goals. No group differences were found for information seeking goals, $F(1,112) = .01, p > .05$.

SPS direct strategies. No group differences were found for the production of didactic strategies $F(1,112) = 1.39, p > .05$. However, group differences were found for commands $F(1, 112) = 5.50, p = .02$. For the complicated mild/moderate group, mean frequency for commands was 5.52 ($SD = 3.09$), and for the control group the mean for commands was 7.42 ($SD = 4.10$).

SPS avoidant strategies. No group differences were found for the production of indirect requests $F(1,112) = 0.90, p > .05$ or the production of questions $F(1,112) = 0.44, p > .05$.

SPS outcomes. Group differences were found for successes $F(1,112) = 4.47, p < .05$. The mean number of successes for the complicated mild/moderate group was 13.39 ($SD = 6.85$) and 16.98 ($SD = 8.46$) for the control group, indicating that the control group's frequency of successes was significantly higher compared to the

complicated mild/moderate group. No group differences were found for frequency of failures $F(1,112) = 0.31, p > .05$.

Severe TBI compared to control group. Paired comparisons on each of the dependent variables were conducted between the severe TBI group and the control group (combined OI and non-injured participants).

SPS high cost goals. No group differences were found between the high cost goals of modifying an action $F(1, 91) = 1.91, p > .05$ or object acquisition $F(1, 91) = 0.83, p > .05$.

SPS low cost goals. No group differences were found between information seeking $F(1,112) = 0.18, p > .05$.

SPS direct strategies. No group differences were found for the production of didactic strategies $F(1, 91) = 1.33, p > .05$. Group differences were found for commands $F(1, 91) = 4.25, p = .04$. For the severe TBI group, mean frequency for commands was 4.60 ($SD = 3.95$), and for the control group the mean for commands was 7.42 ($SD = 4.10$).

SPS avoidant strategies. No group differences were found for the production of indirect requests $F(1, 91) = 0.25, p > .05$ or in the production of questions $F(1, 91) = 0.05, p > .05$.

SPS outcomes. Group differences for successes were trending towards being statistically significant $F(1, 91) = 3.69, p = .058$. The mean number of successes for the severe TBI group was 11.60 ($SD = 7.41$) and 16.98 ($SD = 8.46$) for the control group. No group differences were found for frequency of failures $F(1, 91) = 0.01, p > .05$.

Complicated mild/moderate TBI group compared to OI group. This comparison was conducted for the following two analyses since the OI and non-injured group significantly differed when compared on the high cost goal of stopping an action and the low cost goal of attention seeking.

Stopping an action. No group differences were found for the high cost goal of stopping an action $F(1, 71) = 1.79, p > .05$.

Attention seeking. No group differences were found for the low cost goal of attention seeking $F(1, 71) = 0.03, p > .05$.

Severe TBI group compared to OI group. Secondary analyses were conducted directly comparing a specific injury severity group to the OI group after results revealed that the OI and non-injured group differed on stopping an action and attention seeking.

Stopping an action. No group differences were found for the high cost goal of stopping an action $F(1, 50) = 1.79, p > .05$.

Attention seeking. No group differences were found for the low cost goal of attention seeking $F(1, 50) = 0.41, p > .05$.

III. Aim 3: Impact of Friendship Quality on Observed SPS

For the new set of moderation analyses models, the following *independent* variables were included: combined complicated mild/moderate TBI group compared to the control (OI and non-injured) group; and the severe TBI group compared to the control group. The moderator variables remained the three dimensions of friendship quality, positive, negative and satisfaction. Lastly, the dependent variables remained the SPS outcomes (successes and failures), SPS direct strategies (commands and

didactic), and SPS avoidant strategies (questions and indirect requests). The interaction terms comprised the product of the injury group and each of the three dimensions of friendship quality.

All analyses were conducted using the PROCESS macro add-on in SPSS, version 2.15 (Hayes, 2013). All three dimensions of friendship quality (the moderator) were mean centered and all analyses used Model one provided by the PROCESS package, which is equivalent to testing the moderation model provided in Figure 2.

Complicated mild/moderate TBI compared to control group. Group type was dummy coded with the complicated mild/moderate TBI group serving as the referent group.

SPS direct strategies. Despite the new analyses examining injury severity group break down, hypotheses remained unchanged. The initial hypothesis was that friendships characterized as positive and satisfactory would result in the use of more commands and didactic strategies. Conversely, friendships characterized as highly negative were hypothesized to result in fewer commands and didactic strategies. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and the SPS direct strategies commands and didactic.

SPS commands. Positive friendship quality trended towards being a significant moderator between group type and SPS commands $F(3, 110) = 2.61, p = 0.055, R^2 = .05$. Negative friendship quality was not a significant moderator for the relation between group type and commands $F(3, 110) = 2.42, p = 0.07, R^2 = .05$.

Satisfaction was a significant moderator for the relation between group type and commands $F(3, 110) = 2.89, p = 0.04, R^2 = .05$. Simple slope analysis revealed a significant association between group type and commands for low levels of satisfactory friendship quality ($b = 0.96, t(110) = 2.42, p = .02$) and for average levels of satisfactory friendship quality ($b = 0.72, t(110) = 2.66, p = .001$). When reports of satisfactory friendship were low or average, the complicated mild/moderate TBI group had fewer commands than the control group (Figure 3).

SPS didactic. Positive friendship quality was not a significant moderator between group type and didactic $F(3, 110) = 1.11, p = 0.35, R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type and didactic $F(3, 111) = 1.75, p = 0.16, R^2 = .02$. Satisfaction was not a significant moderator for the relation between group type and didactic $F(3, 110) = 1.43, p = 0.23, R^2 = .03$.

SPS avoidant strategies. The hypothesis was that friendships characterized as positive and satisfactory would result in the production of *fewer* questions and indirect requests. Conversely, it was hypothesized that friendships characterized as highly negative would be associated with production of *more* questions and indirect requests. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and the SPS avoidant strategies questions and indirect requests.

SPS questions. Positive friendship quality was not a significant moderator between group type and questions $F(3, 110) = 0.65, p = 0.58, R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type

and questions $F(3, 110) = 0.71, p = 0.55, R^2 = .02$. Satisfaction was not a significant moderator for the relation between group type and questions $F(3, 110) = 0.32, p = 0.80, R^2 = .01$.

SPS indirect requests. Positive friendship quality was not a significant moderator between group type and indirect requests $F(3, 110) = 0.61, p = 0.61, R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type and indirect requests $F(3, 110) = 0.62, p = 0.60, R^2 = .02$. Satisfaction was not a significant moderator for the relation between group type and indirect requests $F(3, 110) = 0.66, p = 0.57, R^2 = .02$.

SPS outcomes. The initial hypothesis was that friendships characterized as positive and satisfactory would result in more successes and fewer failures. Additionally, it was hypothesized that friendship characterized as highly negative would result in fewer successes and increases in failures. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and SPS successes and failures.

SPS successes. Positive friendship quality was not a significant moderator between group type and successes $F(3, 110) = 2.35, p = .07, R^2 = .05$. Negative friendship quality was trending towards being a significant moderator of the relation between group type and successes $F(3, 110) = 2.75, p = 0.06, R^2 = .05$. Satisfaction was not a significant moderator for the association between group type and successes $F(3, 110) = 1.67, p = 0.17, R^2 = .04$.

SPS failures. Positive friendship quality was not a significant moderator between group type and SPS failure $F(3, 110) = 0.22, p = 0.88, R^2 = .01$. Negative

friendship quality was not a significant moderator for the relation between group type and failures $F(3, 110) = 0.27, p = 0.85, R^2 = .01$. Satisfaction was not a significant moderator for the relation between group type and failures $F(3, 110) = 0.30, p = 0.82, R^2 = .01$.

Severe TBI compared to control group. Group type was dummy coded with the severe TBI group serving as the referent group.

SPS direct strategies. Hypotheses remained that friendships characterized as positive and satisfactory would result in use of more commands and didactic strategies. Conversely, friendships characterized as highly negative were hypothesized to result in fewer commands and didactic strategies. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and the SPS direct strategies commands and didactic.

SPS commands. Positive friendship quality was a significant moderator between group type and SPS commands $F(3, 89) = 6.49, p < 0.01, R^2 = .06$. Simple slope analysis revealed a significant association between group type and commands for low levels of positive friendship quality ($b = 1.13, t(89) = 3.78, p < .001$) and for average levels of positive friendship quality ($b = 1.18, t(89) = 2.80, p = .006$). When reports of positive friendship quality were low or average, the severe TBI group displayed fewer commands compared to the control group (Figure 4).

Negative friendship quality was not a significant moderator of the relation between group type and successes $F(3, 89) = 1.18, p = 0.32, R^2 = .04$.

Satisfaction was a significant moderator for the relation between group type and commands $F(3, 89) = 4.40, p < 0.01, R^2 = .06$. Simple slope analysis revealed

significant association between group type and commands for low levels of satisfactory friendship quality ($b = 2.10$, $t(89) = 2.80$, $p = .006$) and for average levels of satisfactory friendship quality ($b = 1.12$, $t(89) = 3.26$, $p = .002$). When reports of satisfactory friendship quality were low or average, the severe TBI group on average displayed fewer commands than the control group (Figure 5).

SPS didactic. Positive friendship quality was not a significant moderator between group type and didactic $F(3, 89) = 1.15$, $p = 0.33$, $R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type and didactic $F(3, 89) = 0.92$, $p = 0.43$, $R^2 = .02$.

Satisfaction was a significant moderator for the relation between group type and didactic $F(3, 89) = 3.78$, $p = 0.01$, $R^2 = .05$. Simple slope analysis revealed significant association between group type and didactic strategies for low levels of satisfactory friendship quality ($b = 2.25$, $t(89) = 3.29$, $p = .001$) and for average levels of positive friendship quality ($b = 1.21$, $t(89) = 2.82$, $p = .006$). When reports of satisfactory friendship quality were low or average, the severe TBI group displayed fewer didactic strategies compared to the control group (Figure 6).

SPS avoidant strategies. The hypothesis was that friendships characterized as positive and satisfactory would result in production of *fewer* questions and indirect requests. Conversely, it was hypothesized that friendships characterized as highly negative would be associated with production of *more* questions and indirect requests. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and the SPS avoidant strategies questions and indirect requests.

SPS questions. Positive friendship quality was not a significant moderator between group type and questions $F(3, 89) = 0.99, p = 0.40, R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type and questions $F(3, 89) = 0.74, p = 0.53, R^2 = .02$. Satisfaction was not a significant moderator for the relation between group type and questions $F(3, 89) = 0.66, p = 0.57, R^2 = .01$.

SPS indirect requests. Positive friendship quality was not a significant moderator between group type and indirect requests $F(3, 89) = 0.65, p = 0.58, R^2 = .02$. Negative friendship quality was not a significant moderator for the relation between group type and indirect requests $F(3, 89) = 1.57, p = 0.20, R^2 = .04$. Satisfaction was not a significant moderator for the relation between group type and indirect requests $F(3, 89) = 0.51, p = 0.67, R^2 = .02$.

SPS outcomes. The hypothesis was that friendships characterized as positive and satisfactory would result in more successes and fewer failures. Additionally, it was hypothesized that friendship characterized as highly negative would result in fewer successes and increases in failures. Positive, negative, and satisfaction of friendship quality were separately tested as moderators of the relation between group type and SPS successes and failures.

SPS successes. Positive friendship quality was not a significant moderator between group type and successes $F(3, 89) = 2.42, p = .07, R^2 = .06$. Negative friendship quality was not a significant moderator of the relation between group type and successes $F(3, 89) = 1.18, p = 0.32, R^2 = .04$.

Satisfaction was a significant moderator for the association between group type and successes $F(3, 89) = 8.65, p < .001, R^2 = .06$. Simple slope analysis revealed significant association between group type and successes for low levels of satisfactory friendship quality ($b = 3.36, t(89) = 3.71, p < .001$) and for average levels of satisfactory friendship quality ($b = 1.81, t(89) = 3.96, p < .001$). When reports of satisfactory friendship quality were low or average, the severe TBI group had fewer successes compared to the control group (Figure 7).

SPS failures. Positive friendship quality was not a significant moderator between group type and SPS failure $F(3, 89) = 0.03, p = 0.99, R^2 = .001$. Negative friendship quality was not a significant moderator for the relation between group type and failures $F(3, 89) = 2.37, p = 0.07, R^2 = .04$. Satisfaction was not a significant moderator for the relation between group type and failures $F(3, 89) = 0.22, p = 0.88, R^2 = .01$.

Chapter 5: Discussion

The impetus for the current study was drawn from two bodies of literature, one being the large body of extant literature that has examined the benefits of friendship in non-injured children. Friendship provides numerous opportunities for the practice of skills that are useful (e.g. cooperation, compromise) in SPS situations (Laursen & Pursell, 2009; Strough, Berg, & Meegan, 2001). In order to preserve the longevity inherent in a friendship, children must learn ways to navigate conflict situations and increase the frequency of mutually beneficial outcomes (Newcomb & Bagwell, 1995; Laursen & Pursell, 2009). Studies have shown that working together *with a friend* on a task can result in increased collaboration and fewer instances of social discord (Newcomb & Brady, 1982; Strough, Berg, & Meegan, 2001). That which has been less clear is whether friendship quality directly influences SPS behaviors.

Shifting to the literature on SPS in children with TBI, a growing body of literature suggests that children with TBI do not necessarily exhibit global SPS deficits. Compared to OI children, children with TBI do not differ in their assessment of hypothetical social dilemmas or in their generation of alternative strategies for solving social dilemmas (Janusz et al., 2002). However, children with *severe* TBI have been found to report lower level strategies as the best way to solve social dilemmas (Janusz et al., 2002). In a series of studies, Hanten and colleagues (2008; 2011) replicated findings suggesting that children with TBI prefer less adaptive, egocentric, and impulsive SPS strategies. Conversely, a recent study by Moran and colleagues (2015) indicated that children with TBI did not show a preference for

avoidant strategies and did not show aggressive or vengeful reactions to the dilemmas presented to them. A significant component to the Moran et al. (2015) study was that the SPS hypothetical vignettes had both a peer and a friend serve as the perpetrator. Children with TBI *did* modify their responses to the social dilemmas when the perpetrator was a friend. This sensitivity has also been shown in non-injured populations (Burgess, Wojslawowicz, Rubin, Rose-Krasnor, & Booth-LaForce, 2006). The extant literature leaves open many questions regarding the dynamics related to the SPS behaviors and cognitions of children with TBI.

Using these two bodies of literature as a starting point, one open question relates to what these SPS behaviors of children with TBI look like in real time. Are there subtle behaviors that hypothetical vignettes are not able to capture? Furthermore, how do social dilemmas play out in real time when a child with TBI is engaging with a close friend? Lastly what effect, if any, does the quality of a friendship play in SPS behavioral interchanges?

One aim of this study was to utilize an adapted observational SPS coding scheme with children who have experienced a TBI, OI children, and non-injured children as they worked together with their best friend. Other aims were to examine whether group differences existed in these observed SPS behaviors and to see if friendship quality served as a moderator for the relation between group type and the demonstration of SPS behaviors. These aims will now be further discussed in light of the results.

I. Aim 1: Utilizing an Adapted Observational Coding Scheme of SPS Behaviors

Results related to the use of an adapted observational SPS coding scheme indicated that specific SPS goals, strategies, and outcomes were observable across all groups. The adaptation of the coding scheme showed reliability following a period of coder training.

To the author's knowledge, this is the first study that has demonstrated use of an observational coding scheme for SPS behaviors in children with TBI. The advantages of using such a methodology are many, and include being able to capture subtle social behaviors that questionnaires may miss. Additionally, observational methods allow researchers to view behavior in real time as opposed to having an individual reflect on how they might, or should, behave in any given problem solving situation. Being able to observe problem solving behaviors in real time is especially useful because such situations are more likely to provoke conflict and frustration, thereby resulting in reactions occurring in an emotionally charged state. Questionnaires and vignettes about social problem solving behaviors lack this emotionally labile context.

With the adapted coding scheme, the various goal-strategy sequences were collected. This information provides a more nuanced look at the choice of strategy selection for each goal, as well as the overall flexibility of goal-strategy selection. For example, all groups heavily relied on questions in order to obtain information. Since the nature of the SPS tasks was meant to be novel, information-question was an appropriate and adaptive sequence to utilize. Proportions of successful goal-strategy sequences were provided for each group. All three groups showed high success when using didactic strategies to meet the social goal of modifying an action. As will be

discussed in light of the findings with Aim 2, didactic strategies may have been the most appropriate and mature direct strategy to use with the given SPS origami and knot tying tasks.

Lastly, using the sequencing data trends in successful goal-strategy sequencing by high and low cost goals were formulated. Findings indicated children with TBI, proportionally, had more successes when using low cost strategies compared to high cost strategies. However, regardless of low cost or high cost strategy children with TBI were successful over 50% of the time. Examination of high cost goals indicated a trend supporting initial hypotheses related to group differences and SPS successes, with the TBI group having proportionally fewer high cost goal successes compared to the other two groups. The observational coding scheme utilized in the current study provided novel in-depth information regarding the in-vivo SPS behaviors of children with TBI.

II. Aim 2: Group Differences in Observed SPS between Best Friend Dyads

Most of the initial hypotheses regarding group differences in SPS behaviors were unconfirmed. The hypothesis that children with TBI would produce fewer direct strategies than the comparison groups was partially supported in that they did produce fewer commands, although not fewer didactic strategies. The fact that children with TBI exhibited fewer commands but not fewer didactic strategies is interesting in light of findings regarding SPS outcomes. The *lack* of support for hypotheses presuming children with TBI would have fewer successes indicates that TBI children were able to meet their social goals on a level comparable to children with OI and non-injured children. Didactic strategies are richer in nature compared to commands. Command

phrases such as “give me that” or “do this” are more ambiguous than didactic phrases such as “make a loop” or “fold it down”. Didactic strategies provide more information to the social partner and thus may have been the most appropriate direct strategy to successfully meet the social goals required from the SPS tasks. In this case, children with TBI were appropriately using the most adaptive and direct strategy to meet their social goals.

These findings conflict with previous SPS studies involving children with TBI that indicate children with TBI show preferences for impulsive and egocentric strategies (Janusz et al., 2002; Hanten et al., 2008; 2011). However, there is literature indicating that both children with TBI and OI choose higher level SPS strategies when interacting with a same age peer (Hanten et al., 2008), and both groups modify their responses if SPS dilemmas involve an unknown peer versus a friend. This underscores an important point related to the significance of the social partner. In the current study, all three groups may have been performing at optimal SPS levels due to the fact that their social partner was a friend.

III. Aim Three: Impact of Friendship Quality on Observed SPS

All hypotheses regarding friendship quality serving as a moderator for group type and SPS outcomes, direct strategies, and avoidant strategies when using the transformed SPS values were not supported. However, as stated when re-running analyses using the raw SPS frequency data, the proportions used in the initial transformations may have been masking significant findings. Further, group type was modified by segmenting the TBI group into a complicated/mild moderate group and a

severe TBI group. Additionally, the OI and non-injured groups were combined to create one control group.

Between the complicated mild/moderate TBI group and the control group, satisfactory friendship quality at low and average levels moderated the relation between group and SPS commands. Specifically, complicated mild/moderate TBI participants who rated their friendships as low or average on satisfaction displayed *fewer* commands compared to the control group. This indicates that for children with complicated mild or moderate TBI, the extent to which they perceive their friendships as satisfactory may influence their use of direct SPS strategies.

The most striking results came from moderation analyses involving the severe TBI group and control group. The positive and satisfactory friendship quality subscales served as a moderator between group and commands at low and average levels. Specifically, compared to the control group, the severe TBI group had a *lower* display of commands when positive and satisfactory friendship quality was low or average. Alternatively, when positive and satisfactory friendship quality was high, there were no group differences in the mean frequency of commands. Similar results were found for low and average ratings of satisfactory friendship quality between the severe TBI and control group when the SPS outcomes were didactic strategies and successes.

To the author's knowledge, this is the first study to examine how friendship quality moderates the relation between TBI, OI, and non-injured participants and observed SPS behaviors. These results suggest that, especially for children with severe TBI, friendships perceived as not being highly positive or highly satisfactory

may have implications for the display of *direct* SPS strategies and SPS successes. As discussed earlier, the direct SPS strategies were conceptualized as being more mature strategies compared to the indirect SPS strategies. Children with severe TBI who perceived their friendships as low in support and satisfaction may be relying on less mature avoidant strategies to meet their social goals. Whereas previous research has found that children with severe TBI who do not have a mutual friend are at greater risk for victimization and rejection in the classroom (Yeates et al., 2013), the current study speaks to how friendship *quality* may influence more advanced socio-cognitive behaviors.

It was surprising that the global codes related to successes and failures did not relate to the global composites of positive or negative friendship quality. The assumption that friendships characterized as positive would be associated with more SPS successes (and negative friendships associated with more SPS failures) may have been too simplistic. One benefit that friendship offers is the ability to disagree without fear of repercussion or dissolution of the relationship (Hartup & Laursen, 1993; Laursen & Pursell, 2009). Friends may have been more comfortable disagreeing, refusing or partially fulfilling their partner's social initiations. The SPS outcome frequencies (successes, failures, follow-up after failures, and partial successes) may have shown more successes and partial successes had the social partner been an unknown peer.

IV. Limitations and Future Directions

Limitations. Generalizations regarding the SPS behaviors of children with TBI should be made with caution. The current sample was comprised of a subset

from the larger SOBIK study, and only included participants who were able to complete a second laboratory visit with a friend. Previous research with the same SOBIK data has indicated that children with TBI who reported having a mutual friend in the *classroom* were higher functioning than those who did not report having a mutual friend (Yeates et al., 2013). Children with TBI who identified a mutual classroom friend were more likely to be perceived as popular, more likely to be accepted by peers, and less likely to be victimized than those without a mutual friend. Further, children with severe TBI were the least likely of all TBI children to have a mutual friend in the classroom (Yeates et al., 2013). For the current study, while the friend who accompanied children with TBI to the laboratory visit was not necessarily the nominated classroom friend, the results gathered mirror the same caution regarding generalizing results to *all* children with TBI. Consideration must be made for the possibility that children with TBI who identified a friend to bring in to the second laboratory visit had higher levels of social functioning than those who did not bring a friend, which may also account for the lack of findings regarding group differences.

One methodological limitation of the current study was the nature of the two SPS tasks. Children with TBI, OI, and non-injured children who were 5th graders all completed the origami task. As it was the author's decision to prioritize age-matching with the non-injured group, non-injured 6th graders were included in the study, and those participants completed a knot tying task. In conception and instructions the two tasks were similar; each had three models of varying degrees of difficulty, and all dyads received similar instructions highlighting the importance of working together.

However, there may have been some inherent difference between tying knots and folding paper. One task may have been more likely to produce certain SPS statements and behaviors, compared to the other task. Future studies involving in-vivo SPS tasks would be greatly strengthened by having similar tasks for all participants.

The adapted observational coding scheme was limited to social problem solving behaviors that were expressed verbally. There were no codes that captured the general affect of the dyad (i.e. laughter), prosocial/positive behaviors (e.g. compliments, helping behaviors) and other non-verbal behaviors that are indicative of frustration (e.g. eye rolling, heavy sighing, use of sarcasm). It is very possible that the coding scheme did not capture significant aspects of socially interactive behaviors and friendship quality.

Future Directions. The problem solving task was chosen for the current study as it was presumed to be the task that would elicit the highest frequency of SPS goals, strategies, and outcomes across all codes. Since the participants in the current study were older than participants used in previous studies utilizing the observational SPS coding scheme (Rose-Krasnor & Rubin, 1983; Stewart & Rubin, 1995), the problem solving task was also presumed to provide a context with heightened frustration and therefore increased instances of conflict between the best friend dyads. However, using the adapted SPS coding scheme across different contexts is one consideration for future directions. Each of the groups included in the current study participated in a free play session, a planning a weekend session, and a moral dilemma problem solving session. Applying the coding scheme to each dyad across *all* sessions may reveal trends related to the successes/failures of particular goals and strategies.

A future direction, briefly touched on earlier, is to have children with TBI engage in similar SPS tasks with a friend and then separately with an unknown peer. The current study may have been capturing the SPS behaviors of children with TBI at an optimal level due to the context involving their best friend. Navigating problem situations with an unknown social partner may be a more difficult task because there is no indication of how receptive, disruptive, or collaborative the unknown partner will be. With an unknown peer, there is no ritualized script to fall back on when conflict arises. Being able to observe such a situation could provide an in-depth evaluation of TBI children's flexibility in their SPS repertoires and behaviors.

Another perhaps daunting, but useful future direction would be to assess SPS with both observational methodology and hypothetical situation vignettes in order to examine whether both can reliably assess SPS behaviors. Ideally, both measures would include scenarios with an unknown peer and with a friend. A strength of using hypothetical vignettes is the ability to gain insight into the cognitions underlying SPS behaviors. Using observational methodology may provide a more accurate depiction of how children act in a real-time problem solving situation, but it makes it difficult to ascertain *why* certain SPS behaviors are exhibited.

Lastly, the SPS coding scheme utilized captured SPS of best friend dyads without any indication of how successful each *individual* social partner was in their requests. The current scheme captured overall SPS goals, strategies, and outcomes of the *dyad*, but future research should consider examining the reciprocity of SPS exchanges between each friend. It may be the case that the TBI dyad successes were driven by the social sensitivity demonstrated by the friends of children with TBI.

When responding to their friend's social bids, children with TBI may not have been as receptive.

V. Conclusions

The current study provided an initial step towards how to use observational methodology with a clinical pediatric population in order to better understand certain social outcomes following injury. The use of an observational methodology of SPS behaviors is a novel addition to the literature examining social outcomes following childhood TBI. Globally, there were no group differences in SPS didactic strategies, SPS avoidant strategies, or SPS outcomes. These results may extend only to children with TBI who have better social adjustment, as not all children with TBI were able to identify a friend to bring in for their second laboratory visit. The lack of group differences might also be attributable to the fact that a friend was chosen as the social partner. Moran et al. (2015) found that children with TBI altered their hypothetical-reflective SPS responses when the perpetrator was a friend versus a peer. Certain features of the friendship dynamic may keep SPS behaviors at a mature level. Identifying the SPS cognitions and behaviors that differ when interacting with a friend versus unknown peer could prove useful for interventions designed to improve social outcomes following pediatric brain injury.

Moderation analyses indicated that children with severe TBI who had less positive or satisfactory friendships displayed fewer adaptive and direct SPS strategies, as well as fewer successful outcomes, compared to OI and non-injured participants. These analyses fall in line with previous studies that suggest children with severe TBI are most vulnerable to poor psychosocial outcomes (Janusz et al., 2002; Yeates et al.,

2013). These findings offer a useful preliminary glimpse as to how friendship quality may influence nuanced SPS behaviors of children with brain injury.

The current study provided a foundation for the exploration of many different research questions regarding SPS and children with TBI. Related to the Yeates et al. (2007) model of social competence in children with brain disorder, the current findings added a more nuanced depth to the assessment of SPS via the use of observational methodology. Additionally, examining best friend dyads provided another level of detail to the social interaction component of the model. The examination of these components and their associations with one another works toward a more comprehensive understanding of how social adjustment, social interactions, and social information processing are affected following pediatric brain injury.

Table 1.

TBI and OI Sample Demographics

	Group			
	TBI (<i>n</i> = 41)		OI (<i>n</i> = 43)	
	<i>n</i>	%	<i>n</i>	%
Sex (male)	25	61.0	27	62.7
Race (white)	39	95.1	41	95.3
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age at injury (years)	8.30	2.02	7.68	1.85
Age at laboratory assessment (years)	10.78	1.50	10.61	1.61
Time from injury to laboratory assessment (years)	2.48	1.30	2.93	1.08
SES composite standard score	0.05	0.81	0.25	0.94
Full Scale IQ ^a	105.07	11.22	110.5	12.84
Lowest Glasgow Coma Scale score	11.34	4.64		

Note. No significant differences between groups. TBI = traumatic brain injury, OI = orthopedic injury, SES = socioeconomic status.

^aIQ measured using two-subtest version of Wechsler Abbreviated Scale of Intelligence

Table 2.

Demographics by Completion of Best Friend Measures – TBI

	Group			
	TBI with Best Friend Measures (<i>n</i> = 41)		TBI without Best Friend Measures (<i>n</i> = 41)	
	<i>N</i>	%	<i>n</i>	%
Sex (male)	25	61.0	29	71.0
Race (white)	39	95.1	25	61.0
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age at injury (years)	8.30*	2.02	7.35*	1.74
Age at assessment (years)	10.78*	1.50	9.94*	1.39
Time from injury to assessment (years)	2.48	1.30	2.60	1.14
SES composite standard score	0.05*	0.81	-0.49**	0.99
Full Scale IQ ^a	105.07*	11.22	93.08*	14.96
Lowest Glasgow Coma Scale score	11.34	4.64	10.24	5.17
BASC externalizing	50.30	1.82	56.40	2.58

Note. TBI = traumatic brain injury, SES = socioeconomic status.

* = $p < .05$

** = $p < .01$

SES was a composite of maternal education, median census income, and family socioeconomic index

^aIQ measured using two-subtest version of Wechsler Abbreviated Scale of Intelligence

Levene's test indicated equal variances between groups for all significant variables, Age at Injury: $F(1; 80) = .54, p = .46$; Age at assessment: $F(1; 80) = .92, p = .34$; IQ: $F(1; 79) = 2.21, p = .14$; SES: $F(1; 80) = .82, p = .37$.

Table 3.

Demographics by Completion of Best Friend Measures – OI

	Group			
	OI with Best Friend Measures (<i>n</i> = 43)		OI without Best Friend Measures (<i>n</i> = 18)	
	<i>N</i>	%	<i>n</i>	%
Sex (male)	25	62.7	12	63.2
Race (white)	38	95.3	16	84.2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age at injury (years)	7.96	1.70	8.0	1.70
Age at assessment (years)	10.65	1.61	10.51	1.86
Time from injury to assessment (years)	2.93	1.08	2.55	.71
SES composite standard score	0.28	0.93	0.33	1.19
Full Scale IQ ^a	110.5	12.99	108.32	14.5
BASC externalizing	48.18	1.11	51.0	1.92

Note. No significant differences between groups. OI = orthopedic injury, SES = socioeconomic status.

SES was a composite of maternal education, median census income, and family socioeconomic index

^aIQ measured using two-subtest version of Wechsler Abbreviated Scale of Intelligence

Table 4.

Means and Standard Deviations of Friendship Quality by Group

Dimensions of Friendship Quality	TBI Group <i>M (SD)</i>	OI Group <i>M (SD)</i>	Non-Injured Group <i>M (SD)</i>
Positive Friendship Quality	3.91 (0.74)	3.56 (0.59)	3.88 (0.58)
Negative Friendship Quality	1.56 (0.56)	1.53 (0.57)	1.68 (0.61)
Satisfactory Friendship Quality	4.57 (0.52)	4.42 (0.56)	4.49 (0.53)

Table 5.

Observed SPS Goal Descriptives by Group

	TBI	OI	Non-Injured
Attention Seeking			
Mean (sd)	4.49 (3.52)	4.76 (3.51)	6.80 (3.53)
Frequency	184	200	279
Modify an Action			
Mean (sd)	6.85 (4.69)	8.69 (5.23)	9.37 (6.48)
Frequency	281	365	384
Information			
Mean (sd)	3.95 (2.36)	4.10 (2.77)	4.07 (2.82)
Frequency	162	172	167
Stop an Action			
Mean (sd)	1.78 (1.72)	2.43 (2.43)	1.27 (1.61)
Frequency	73	102	52
Object Acquisition			
Mean (sd)	1.22 (1.57)	1.86 (2.05)	1.46 (1.69)
Frequency	50	78	60
Redirection			
Mean (sd)	.22 (.61)	.24 (.87)	.07 (.34)
Frequency	9	10	3

Table 6.

Observed SPS Strategy Descriptives by Group

	TBI	OI	Non-Injured
Command			
Mean (sd)	5.29 (3.29)	7.38 (4.75)	7.46 (3.37)
Frequency	217	310	306
Didactic			
Mean (sd)	7.10 (4.76)	7.88 (4.34)	9.56 (7.10)
Frequency	291	331	392
Explanation of Consequences			
Mean (sd)	.51 (.87)	.64 (.98)	.73 (1.18)
Frequency	21	27	30
Aggressive			
Mean (sd)	.22 (.72)	.33 (.84)	.15 (.57)
Frequency	9	14	6
Question			
Mean (sd)	4.24 (2.63)	4.95 (3.18)	4.27 (2.92)
Frequency	174	208	175
Indirect Request			
Mean (sd)	1.34 (1.57)	1.33 (1.64)	.76 (1.26)
Frequency	55	56	31
Grab			
Mean (sd)	2.27 (2.16)	3.10 (3.05)	1.61 (1.71)
Frequency	93	130	66
Orienting			
Mean (sd)	6.59 (4.63)	7.71 (4.64)	9.49 (6.63)
Frequency	270	324	389

Table 7.

Observed SPS Outcome Descriptives by Group

	TBI	OI	Non-Injured
Success			
Mean (sd)	12.95 (6.94)	16.21 (8.37)	17.76 (8.58)
Frequency	531 (70% success)	681 (73% success)	728 (78% success)
Failure			
Mean (sd)	3.22 (2.66)	3.55 (2.70)	3.32 (2.37)
Frequency	132	148	136
Partial Success – Acknowledgement			
Mean (sd)	1.00 (1.30)	.90 (1.16)	.46 (.84)
Frequency	41	38	19
Partial Success – Partial Compliance			
Mean (sd)	.20 (.45)	.26 (.62)	.12 (.33)
Frequency	8	11	5
Partial Success – Clarification			
Mean (sd)	1.12 (1.26)	1.29 (1.29)	1.44 (1.70)
Frequency	46	54	59

Table 8.

Observed SPS Follow-up After Failure Descriptives by Group

	TBI	OI	Non-Injured
Modified			
Mean (sd)	.22 (.41)	.24 (.53)	.49 (1.02)
Frequency	9	10	20
No Attempt			
Mean (sd)	1.88 (1.76)	2.17 (2.11)	1.76 (1.24)
Frequency	79	91	72
Clarification			
Mean (sd)	.24 (.58)	.24 (.48)	.12 (.40)
Frequency	10	10	5
Rigid			
Mean (sd)	.44 (.80)	.62 (.93)	.80 (1.3)
Frequency	18	26	33
Self-Solution			
Mean (sd)	.39 (.66)	.26 (.49)	.15 (.35)
Frequency	16	11	6
Persistence Index	40% (53/132)	39% (57/148)	47% (64/136)

Table 9.

Correlations between Friendship Quality Moderator Variables and SPS Dependent Variables

	Failure	Success	Indirect Request	Question	Command	Didactic	Positive Friendship Quality	Negative Friendship Quality	Satisfaction Friendship Quality
Failure	1								
Success	-.76**	1							
Indirect Request	-.04	-.12	1						
Question	.25**	-.15	-.01	1					
Command	.23*	-.19*	.24*	-.11	1				
Didactic	-.27**	.10	-.06	-.42**	-.39**	1			
Positive Friendship Quality	-.06	.03	-.06	.02	-.01	.02	1		
Negative Friendship Quality	.06	-.05	-.01	-.01	.17	.07	-.06	1	
Satisfaction Friendship Quality	-.04	-.01	-.06	.07	-.07	.01	.71**	-.17	1

Table 10.

Correlations between SPS Dependent Variables and the Interaction of Friendship Quality and Group Type (OI vs. TBI)

	Failure	Success	Indirect Request	Question	Command	Didactic	D1xPositive Friendship Quality	D1xNegative Friendship Quality	D1 x Satisfaction Friendship Quality
Failure	1								
Success	-.76**	1							
Indirect Request	-.04	-.12	1						
Question	.25**	-.15	-.01	1					
Command	.23*	-.19*	.24*	-.11	1				
Didactic	-.27**	.10	-.06	-.42**	-.39**	1			
D1xPositive Friendship Quality	.02	.01	-.06	.09	.07	-.12	1		
D1xNegative Friendship Quality	.03	-.004	.04	.03	.02	.07	-.06	1	
D1 x Satisfaction Friendship Quality	.05	-.10	-.01	.13	.07	-.13	.71**	-.17	1

Table 11.

Correlations between SPS Dependent Variables and the Interaction of Friendship Quality and Group Type (Non-injured vs. TBI)

	Failure	Success	Indirect Request	Question	Command	Didactic	D2xPositive Friendship Quality	D2xNegative Friendship Quality	D2 x Satisfaction Friendship Quality
Failure	1								
Success	-.76**	1							
Indirect Request	-.04	-.12	1						
Question	.25**	-.15	-.01	1					
Command	.23*	-.19*	.24*	-.11	1				
Didactic	-.27**	.10	-.06	-.42**	-.39**	1			
D2xPositive Friendship Quality	-.08	.15	-.17	-.01	-.12	.06	1		
D2xNegative Friendship Quality	-.01	-.05	.07	-.08	.15	.13	-.05	1	
D2 x Satisfaction Friendship Quality	-.06	.11	-.16	.05	-.13	.02	.71**	-.16	1

Table 12.

Successful strategies within goals - TBI

	Command	Didactic	Explanation of Consequences	Question	Indirect Request	Total
Attention Seeking	59 (38%)	51 (32%)	7 (5%)	19 (12%)	21 (13%)	157
Modify Behavior	21 (12%)	119 (70%)	7 (4%)	3 (2%)	20 (12%)	170
Information	0	0	0	97 (100%)	0	97
Stop an Action	33 (72%)	13 (28%)	0	0	0	46
Object Acquisition	19 (79%)	0	0	3 (32%)	2 (8%)	24

Parentheses indicate percentage of goal-strategy sequence from the total for each goal

Table 13.

Successful strategies within goals – OI

	Command	Didactic	Explanation of Consequences	Question	Indirect Request	Total
Attention Seeking	87 (52%)	53 (32%)	8 (5%)	12 (7%)	6 (4%)	166
Modify Behavior	72 (27%)	178 (66%)	6 (2%)	2 (1%)	13 (5%)	271
Information	0	0	0	99 (99%)	1 (1%)	100
Stop an Action	45 (67%) (11%)	18 (27%) (44%)	3 (4%) (33%)	0	1 (1%) 0	67
Object Acquisition	30 (56%) (3%)	3 (5%) 0	0	10 (19%) (10%)	11 (20%) (9%)	54

Parentheses indicate percentage of goal-strategy sequence from the total for each goal

Table 14.

Successful strategies within goals – Non-Injured

	Command	Didactic	Explanation of Consequences	Question	Indirect Request	Total
Attention Seeking	119 (49%)	95 (39%)	19 (8%)	7 (3%)	1 (1%)	241
Modify Behavior	87 (30%)	184 (64%)	4 (1%)	2 (1%)	12 (4%)	289
Information	2 (1.5%)	0	0	127 (98%)	1 (0.5%)	130
Stop an Action	30 (79%)	7 (18%)	1 (3%)	0	0	38
Object Acquisition	34 (72%)	0	0	7 (15%)	6 (13%)	47

Parentheses indicate percentage of goal-strategy sequence from the total for each goal

Table 15.

Proportions of Successful High vs. Low Cost Goals – All Groups

	TBI	OI	Non-Injured
Successful High Cost Goals (Modify Behavior; Stop an Action; Object Acquisition)	60% (240/404)	72% (392/545)	75% (374/496)
Successful Low Cost Goals (Attention Seeking; Information)	73% (254/346)	71% (266/372)	83% (371/446)

Figure 1.

Model of Social Competence in Children with Brain Disorder (Yeates et al., 2007)

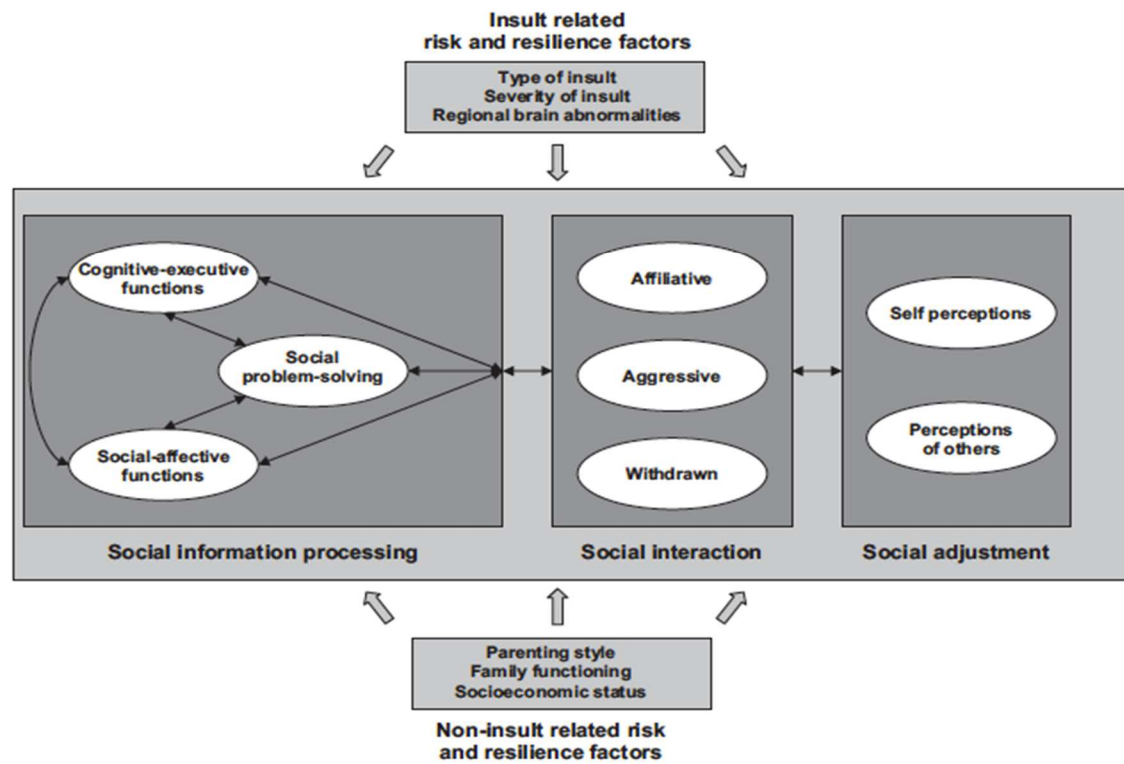


Figure 2.

Moderation of Friendship Quality on Group Membership and Observed SPS

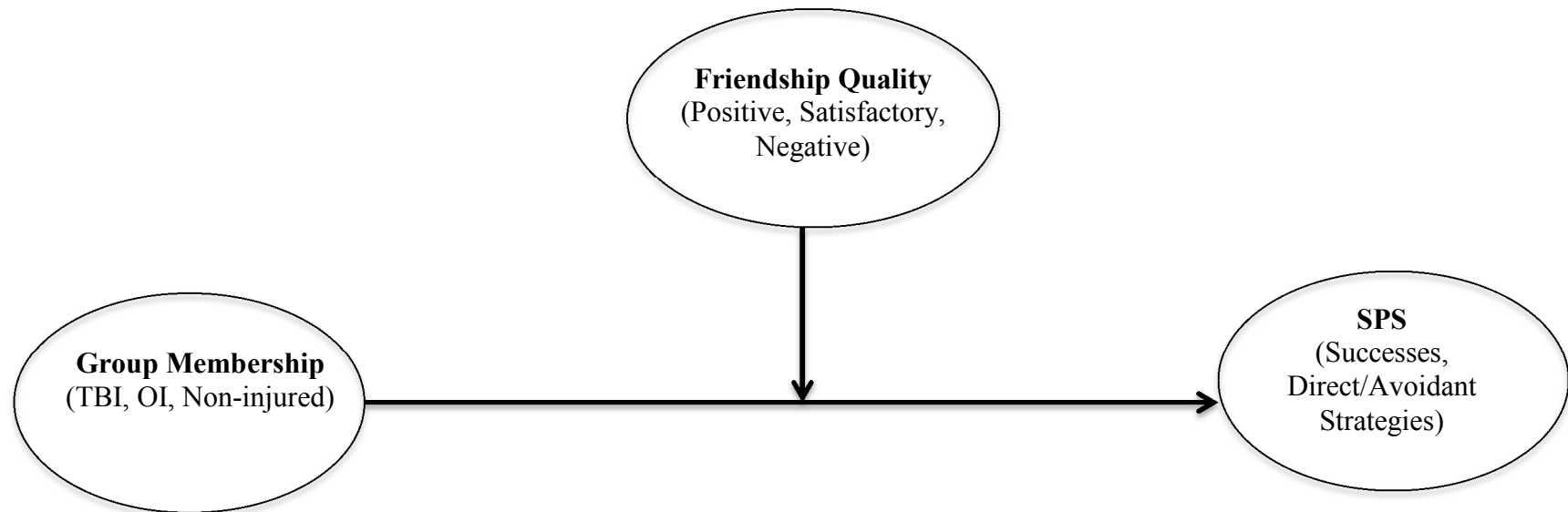


Figure 3.

Effect of Satisfactory Friendship Quality on the Association between Group Type and Commands

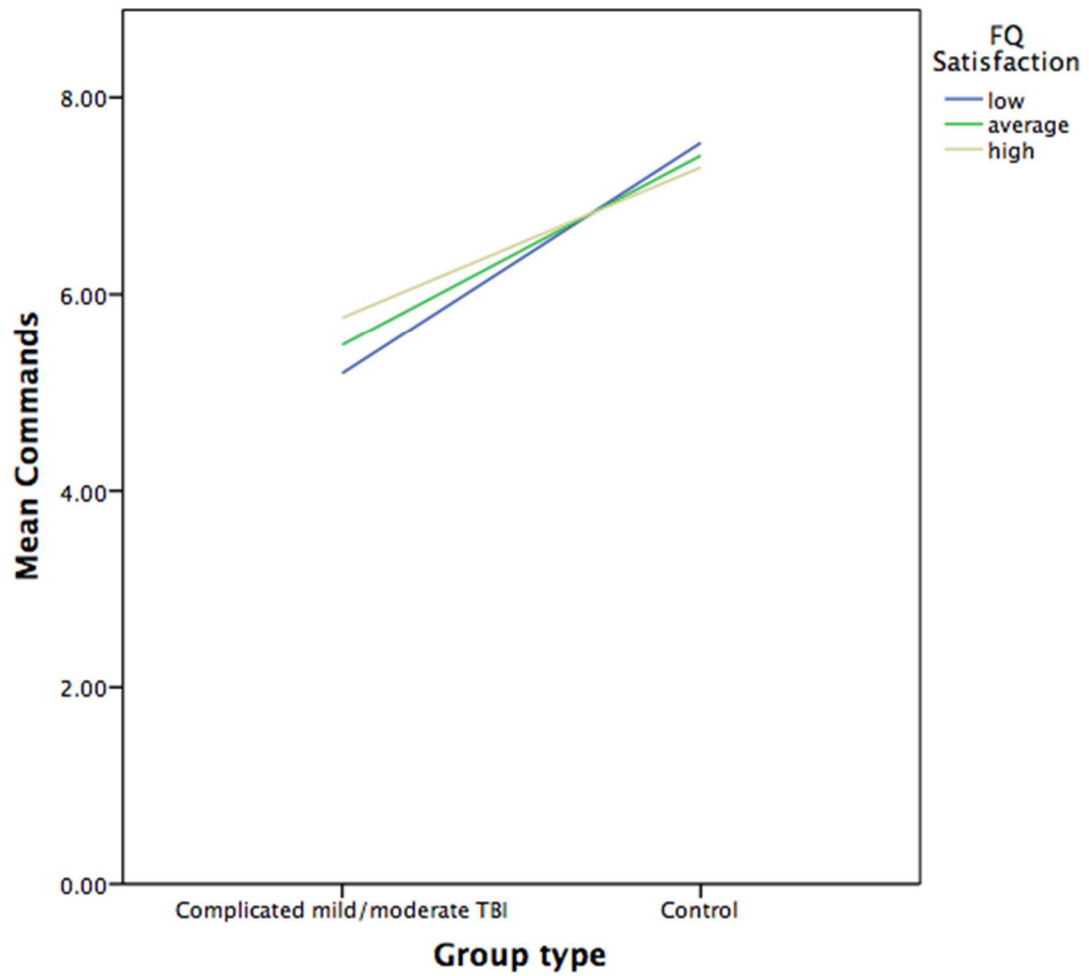


Figure 4.

Effect of Positive Friendship Quality on the Association between Group Type and Commands

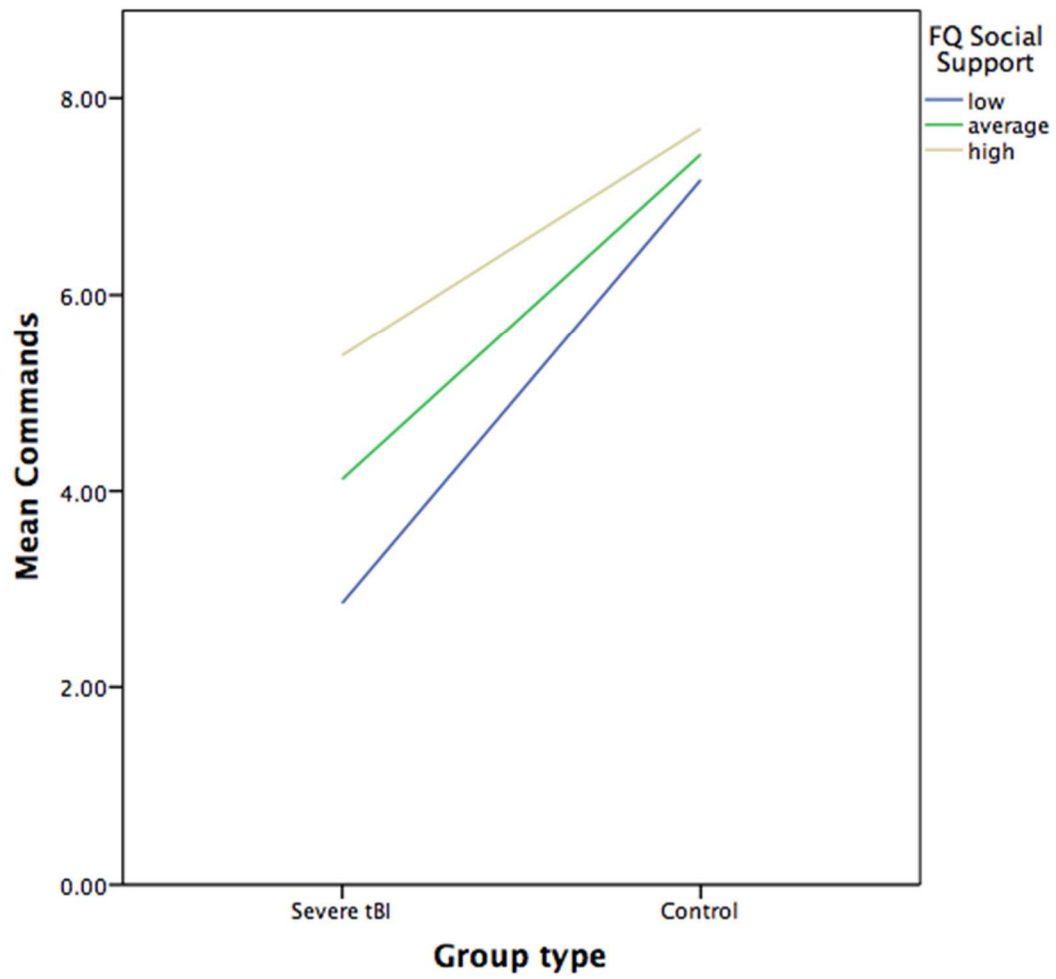


Figure 5.

Effect of Satisfactory Friendship Quality on the Association between Group Type and Commands

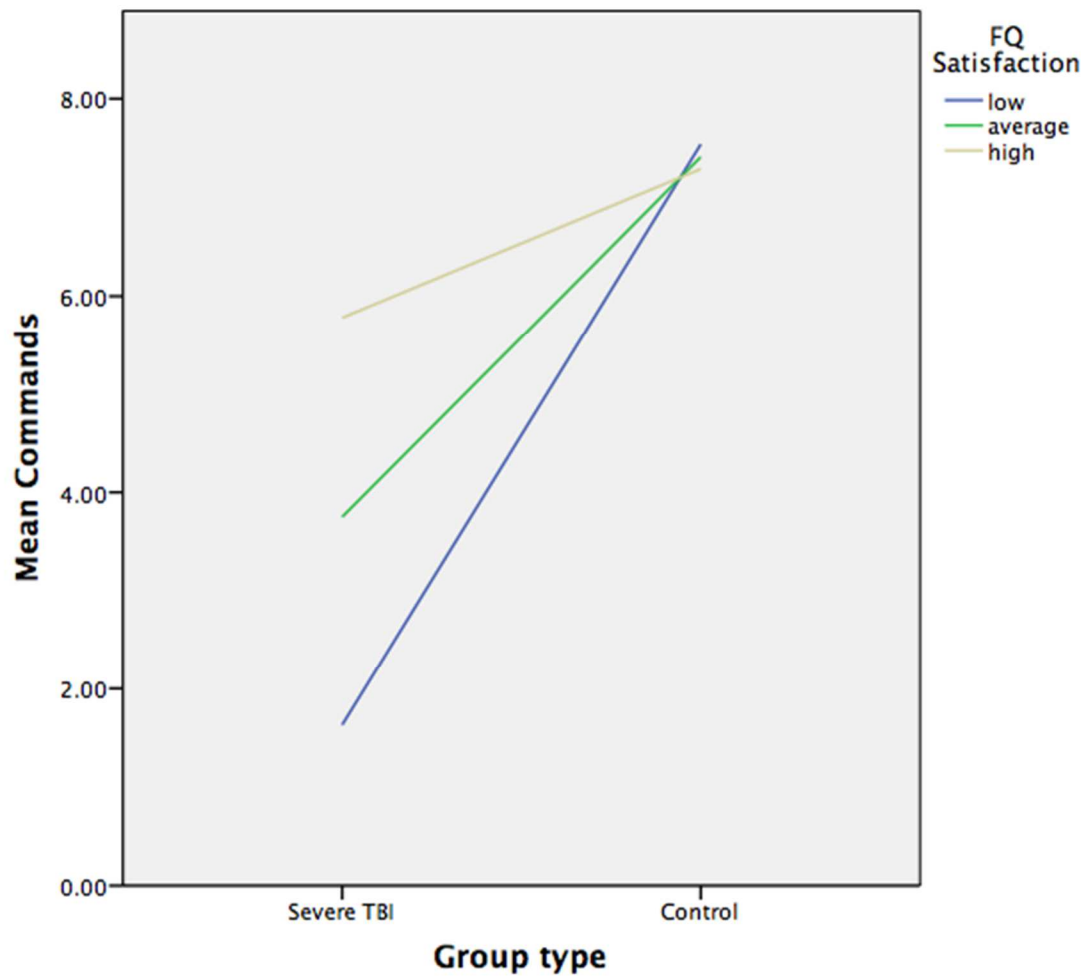


Figure 6.

Effect of Satisfactory Friendship Quality on the Association between Group Type and Didactic

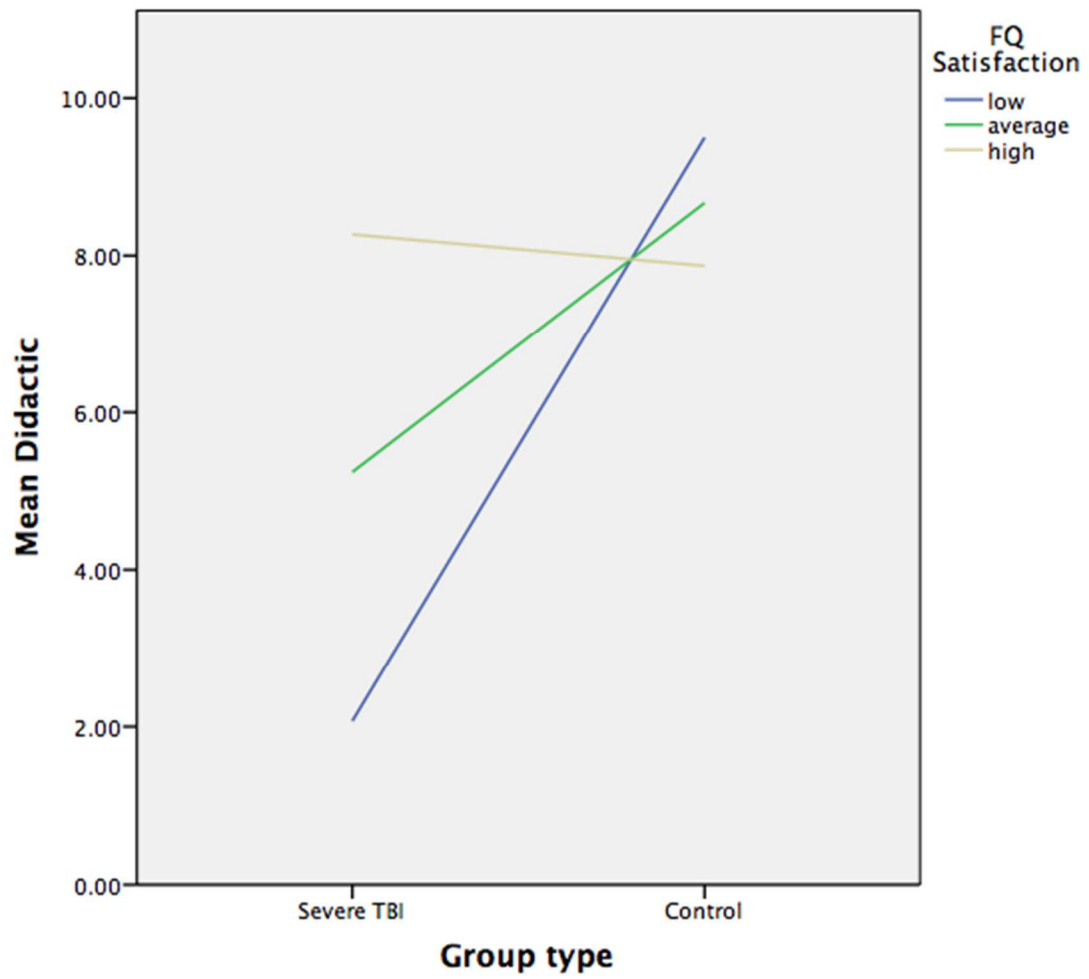
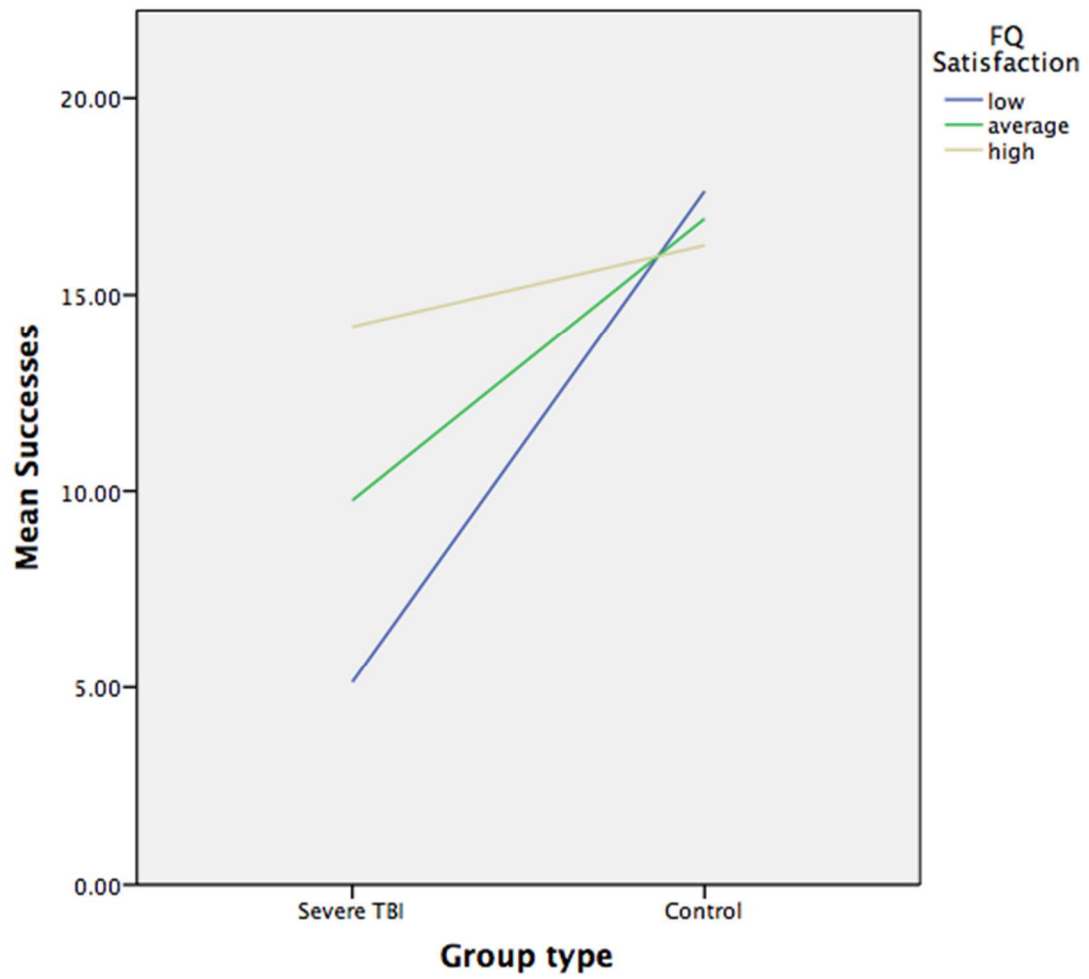


Figure 7.

Effect of Satisfactory Friendship Quality on the Association between Group Type and Successes



*Social Problem Solving Observational Coding Taxonomy- Revised
2000*

Overview

Social-problem solving (SPS) attempts are socially-oriented initiations which one person (the initiator, referred to also as the focal child) uses to influence another person (the target, referred to also as the nonfocal child). In coding these attempts, the critical variables are: the initiator's goals, his/her strategies used to achieve these goals, the outcome of SPS attempt and the affect associated with the SPS attempt.

The SPS coding scheme has derived from research on dyads of children ranging in age from 4 to 8 years, the present version of the coding scheme has been modified for use with children in groups of four. For the most part, the paradigm used in the development of the coding scheme was naturalistic in nature; typically, groups of same-age, same-sex children were video-taped during play. The present coding scheme was developed for use with these videotapes.

The purpose of this manual is to provide researchers with a useful scheme for coding social-problem solving attempts between children. The manual contains a detailed description of the transcription and coding procedures and includes definitions for all coding categories along with general coding guidelines.

Coding Social-Problem Solving Attempts

There are six components in the coding of social-problem solving attempts. These components include: goals, strategies, outcomes, affect, proximity and physical orientation. In coding an SPS attempt, one category is chosen from each of the six components; together these units describe the entire SPS episode. In addition to the coding of the above outlined components, a verbatim transcript of the entire interaction is recorded along with the start-time of the SPS attempt and the identification numbers of both the initiator and the target child(ren).

Goals

1. Joint action

Attempts to initiate social play or a joint activity. In social play, an individuals' actions are contingent upon his/her partner's actions (i.e., are related in content and occur within 10 seconds) (e.g., "Want to play checkers?"; [While playing 'house'] "Now, you be the mommy and I'll be the daddy."; [while playing cards] "Let's play a different game."). In a joint activity, two or more individuals are engaged in a non-play activity with a common purpose or goal (e.g., "Let's clean the room up now.").

2. Play solitary

Attempts to initiate or maintain solitary behaviour (e.g., "I'm bored of this game, I don't want to play anymore" [leaves the joint play activity]; [As target is hovering near initiator] "Leave me alone please.").

3. Object acquisition/access

Attempts to acquire any object or gain control (i.e., take any amount of control away from target) of any object that is in the possession of the target (e.g., "Give me Ernie!"; "Can I turn the wheel now?"; [Without asking, initiator reaches over and moves controller of electronic game target child is playing with]; [initiator picks up and moves remote-controlled car that the target is using]).

The only goal of the attempt is to have or be in control of the object.

4. Attention

Attempts to get the attention of the target. Attention may be to self or to another person or thing (e.g., "Hey, look at me!"; "Can you see the plane in the sky?"; "Look at her hair!" [points]).

5. Information

Attempts to acquire information about self (i.e., feedback or evaluation), the target, a third person, place, event or thing (e.g., "Does my hair look ok?"; "What is your name?"; "Is that the researcher?"; "When is Saturday?"; "Why is this thing here?"). Two cases not to be coded as 'information' are: 1) requests for verbal repetition (e.g., "What did you say?") and 2) rhetorical questions (e.g., "You know what? I got a new bike today!"). "Information" does not help the task or joint activity.

6. Assistance

Attempts to gain help, comfort or instruction from the target (e.g., "Can you tie my shoe?"; "I want my mom, please call her for me."; "Can you show me how to play 'Go Fish'?").

7. Prosocial (sharing/assisting)

Any attempt to share with or give assistance to the target (e.g., "Here, Paul, you can play with the car now." [hands Paul car]; [initiator helps the target get up after falling over chair]). These initiations must be unsolicited, therefore, responses to requests by the target are not to be coded. Can be positive or negative. Any attempt that helps the task.

8. Stop action

The initiator requests that the target cease doing some activity either inside or outside of the context of play (e.g., "Stop singing, I don't like it!"; "Don't talk to me."; [While playing a board game] "Hold on, stop; it's my turn."). Highest order goal.

9. Elicit action

The initiator requests that the target physically engage in some activity not codable elsewhere in the other goals outlined (e.g., "Come here please."; "Hold this." [hands target a ball]; "Pardon me; what did you say?"). The action requested is unrelated to the task or joint activity. Very specific action.

10. Elicit Action – Self

The initiator asks for permission to do something themselves. Only coded in the context of joint action (e.g., "I am going to work on the frog now"; "I am going to move this up")

Strategies

1. Aggressive Physical

Initiator uses physical aggression in conjunction with any other strategy (e.g., "Stop that!" [initiator hits target]; "I want the ball!" [initiator pushes target away from the ball]).

2. Aggressive Verbal

Initiator uses verbal aggression (but not physical aggression) in conjunction with any other strategy. Verbal aggression is considered to be any personal verbal attacks (e.g., "Give me that you dummy!"; "I don't want to play with ugly people like you!").

3. Incentives (negative or positive)

The initiator uses either negative or positive incentives to gain the target's compliance. Negative incentives are threats of retribution for non-compliance to the request (e.g., "Give me the doll or I'll hit you!"; "Leave me alone or I'll tell!") while positive incentives are bribes (i.e., payment for compliance) (e.g., "I will be your friend if you give me the car."; "Let me play with you and I will give you a piece of gum."). The coder is to specify the type of incentive used by the initiator.

4. Questions

Initiator asks a question (e.g., "How does this work?"; "Why did you laugh?"). This does not include suggestions or imbedded imperatives (see Indirect Requests, below).

5. Indirect Request

Indirect requests are directed declaratives (i.e., declaratives directed at the target specifically, for example, through physical orientation to the target or the use of the target's name) (e.g., [looking at target] "I need some paper."; "Sue, I would give anything to have your beach ball."), suggestions (e.g., "How about we play house?", "Why don't we try to escape?"), interrogatives (e.g., "Can you go away?"; "Would you give me the pan?"), or implied requests (e.g., [looking at target] "Your shoe is untied."; "That's not how you should draw a house.").

6. Commands/direct requests

Initiator uses the imperative to issue a direct request (e.g., "Get lost!"; "Give that back!").

7. Non-verbal (gesture/grabbing/reaching)

Initiator uses a strategy that does not require language (i.e., is physical) to be understood by the target as a request. Generally, there are two types of non-verbal strategies, non-invasive and invasive. For non-invasive strategies, the initiator uses some form of gesture to communicate the request to the target (e.g., [initiators hands a toy to the target without speaking or being asked]; [initiator puts finger to lips in request that the target be quiet.]) or the initiator uses some object as a communication device (e.g., [initiator honks horn of play car in an attempt to make target move]).

Gestures are a part of the attempt that carries communicative intent (e.g., showing/waving/pointing). Invasive strategies, on the other hand, include grabbing and reaching.

Grabbing is considered to be the taking, without permission, of anything in the possession of the target child and is a special case of non-verbal strategies, as it might or might not involve aggression. If the action is simply the taking of an item from the target child and does not involve either physical or verbal aggression, it is simply coded as 'non-verbal: grabbing'. However, if the attempt involves physical aggression or seems to be inherently aggressive in nature (i.e., is not simply the initiator taking something in the targets possession but is of a more offensive nature), the strategy is coded as 'aggressive-physical'. Furthermore, if the grabbing is in conjunction with verbal aggression, then 'aggressive-verbal' is coded. To distinguish between aggressive and non-aggressive grabbing, the coder should use cues such as facial expression, tone of voice and the situational context.

Reaching is the touching or handling of or otherwise physically interfering with anything in the possession of the target child (e.g., [initiator brushes the hair of the doll the target is holding]; [initiator pushes the buttons of a calculator being used by the target]; [initiator puts hand in front of the remote-controlled car that the target is operating]). Reaching is distinct from grabbing in that the initiator does not attempt, at any point, to take the object, or control of the object, away from the target child.

8. Other

Initiator uses a strategy not codable into one of the above categories. The coder should try to specify the strategy on the comment line as is best possible.

9. Unknown

The strategy cannot be determined by coder (e.g., [children whisper and cannot be heard]).

Outcome

1. Success

Target complies with request or action, without further involvement by the initiator, within 10 seconds.

2. Partial Success

Target complies partially with request or action, within 10 seconds (e.g., [child gives only one block when ten were requested]. A partial success may also be one in which a compromise of the original goal has been made (e.g., [child states she will share later instead of at the present moment]). Also, acknowledgement of the initiator's SPS attempt without actual compliance to the attempt is also considered a partial success (e.g., I: "Can I have the toy now?", T: "Sure." [Target continues to hold toy]). If the target child does not know the answer it is coded as a partial response.

3. Self-Solution

The initiator achieves the goal by his/herself within 10 seconds after the request has been made (e.g., [target shuts door himself after requesting target to close it]).

4. Rejection

Target refuses to comply within 10 seconds.

5. No response

Target does not respond to initiator's request within 10 seconds.

6. Unknown

The outcome of the SPS attempt cannot be determined by the coder. This inability might be due to video or audio difficulties (e.g., [children are out of view of camera]) or as a result of the interference of a third child (e.g., [third child grabs toy from target immediately after initiator has requested it]). As well, the outcome is coded as 'unknown' if the attempt is either a nonrequest (i.e., Hostile or Affectionate initiations), or requires future compliance (i.e., beyond the time of the experimental session; see 'General Rules and Guidelines' section). Finally, if the SPS attempt is imbedded within a string of independent SPS attempts and the target child does not respond to the attempt, again, 'unknown' is coded for the outcome (see 'General Rules and Guidelines' section).

Affect

1. Positive

Initiator laughs, smiles, giggles and/or chuckles during SPS attempt.

2. Negative (externalizing/internalizing)

Initiator frowns, whines, cries, pouts, knits eyebrows, furrows brow, yells or uses angry tones during SPS attempt. The nature of the negative affect should be specified as being either 'externalizing' (i.e., angry) or 'internalizing' (i.e., sad, anxious, frightened).

3. Neutral

Initiator does not display clear signs of either negative or positive affect as defined here.

5. Unknown

The affect of the initiator is unknown.

Proximity (To Target)

1. Touching

Initiator is in direct contact with target during the majority of the SPS attempt. If children are sitting close and it cannot be determined if they are touching then it is coded as "within arms reach"

2. Within Arms Reach

Initiator is capable of touching the target with one or both hands during the majority of the SPS attempt.

3. Beyond Arms Reach

Initiator is not able to touch the target with either hand during the majority of the SPS attempt.

4. Unknown

The proximity of the initiator to the target is unknown during the SPS attempt.

Orientation

1. Toy/Play Object

Initiator is looks predominantly at toy or play object (of concern) during the SPS attempt.

2. Target Child

Initiator looks predominantly at target child during the SPS attempt.

3. Other Child

Initiator looks predominantly at another child during the SPS attempt; coder must specify identity of other child.

4. Elsewhere

Initiator looks predominantly elsewhere during SPS attempt.

5. Unknown

Orientation of the initiator is unknown during SPS attempt.

Appendix B: GLASGOW COMA SCALE

Glasgow Coma Scale

The **Glasgow Coma Scale**, or **GCS**, is a score of a patient's state of consciousness or coma. It is a universally used, reliable scale that is obtained by evaluating the patient clinically.

The components measured are the motor (M), verbal (V) and eye-opening (E) scores. The sum of the resulting points give a patient score between 3 (indicating deep unconsciousness) and 15 (fully alert).

Grade of TBI	GCS
Severe TBI	≤ 8
Moderate TBI	9 to 12
Mild TBI (MTBI)	≥ 13

Individual elements as well as the sum of the score are important. For example, the score is expressed in the form "GCS 9 = E2 V4 M3"

The Glasgow Coma Scale

	1	2	3	4	5	6
Motor	Makes no movements	Extension to painful stimuli (decerebrate response)	Abnormal flexion to painful stimuli (decorticate response)	Flexion/withdrawal to painful stimuli	Localizes painful stimuli	Obeys commands
Verbal	Makes no sounds	Incomprehensible sounds	Utters inappropriate words	Confused, disoriented	Oriented, converses normally	N/A
Eyes	Does not open eyes	Opens eyes in response to painful stimuli	Opens eyes in response to voice	Opens eyes spontaneously	N/A	N/A



Best motor response (M)

There are six grades, starting with the most severe:

6. **Obeys commands**—Patient does simple things as asked.
5. **Localizes to pain**—Purposeful movements toward painful stimuli, e.g., hand crosses midline and gets above clavicle when supra-orbital pressure is applied.
4. **Flexion/withdrawal to pain**—Flexion of elbow, supination of forearm, flexion of wrist when supra-orbital pressure is applied. Patient pulls part of body away when fingernail bed is pinched.
3. **Abnormal flexion to pain**—Adduction of arm, internal rotation of shoulder, pronation of forearm and flexion of wrist, and the patient has a decorticate response.
2. **Extension to pain**—Abduction of arm, internal rotation of shoulder, pronation of forearm and extension of wrist, and the patient has a decerebrate response.
1. **Patient has no motor response.**

Best verbal response (V)

There are five grades, starting with the most severe:

5. **Oriented**—Patient responds coherently and appropriately to questions, such as the patient's name and age, where they are and why, the year and month.
4. **Confused**—Patient coherently responds to questions, but there is some disorientation and confusion.
3. **Inappropriate words**—Patient makes random or exclamatory articulated speech but no conversational exchange.
2. **Incomprehensible sounds**—Patient moans but no words.
1. **Patient has no verbal response.**

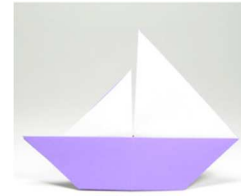
Best eye response (E)

There are four grades, starting with the most severe:

4. **Patient's eyes open spontaneously.**
3. **Eye-opening to speech**—Not to be confused with a waking a sleeping person, these patients receive a score of 4, not 3.
2. **Eye-opening in response to pain**—Patient responds to pressure on the patient's fingernail bed. If this does not elicit a response, supraorbital and sternal pressure or rub may be used.
1. **Patient does not open his eyes.**

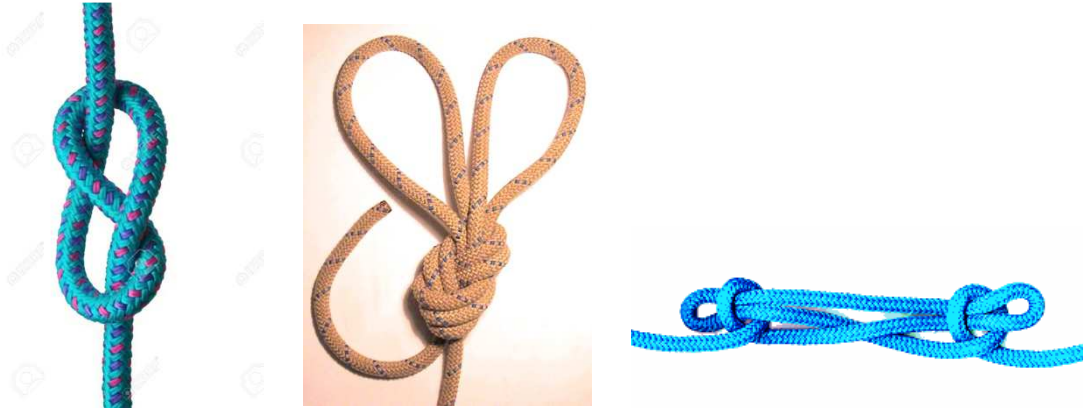


Appendix C: DYADIC ORIGAMI SPS TASK



Protocol: Each best friend dyad was seated at a table. Three pre-made origami figures were placed on the table to serve as models. Extra pieces of origami paper and instructions for each figure were provided. The experimenter read the following script to the dyad: “I would like you to choose to make one of these models and work on it *together*. The jet plane is the easiest one to make, the penguin is the next hardest, and the sailboat is the hardest to make. While they’re all challenging, I want both of you to decide which one you’re going to make *together*. Then you have ten minutes to work on it and if you finish one model you can use a second piece of paper to start another. And remember, both of you should work on one model *together*”. The researcher then left the room for ten minutes for the dyad to work on the task.

Appendix D: DYADIC KNOT TYING SPS TASK



Protocol: Each best friend dyad was seated at a table. Three pre-made knots were placed on the table to serve as models. Three extra pieces of rope and instructions for each knot were provided. The experimenter read the following script to the dyad: “I would like you to choose to make one of these models and work on it *together*. The first knot is the easiest one to make, the second knot is the next hardest, and the third knot is the hardest to make. While they’re all challenging, I want both of you to decide which one you’re going to make *together*. Then you have ten minutes to work on it and if you finish one model you can use one of the other ropes to start another. And remember, both of you should work on one model *together*”. The researcher then left the room for ten minutes for the dyad to work on the task.

Appendix E: FRIENDSHIP NOMINATION QUESTIONNAIRE

Children's Friendship Study _____

THREE BEST FRIENDS

Please list your three best friends that are of your same gender and within 1 grade level of your current grade.

Best Friend _____

Second Best Friend _____

Third Best Friend _____

Appendix F: NETWORK OF RELATIONSHIPS INVENTORY

CHILD'S ID #: _____ DATE: _____

Network of Relationships Inventory

Everyone has a number of people who are important in their life. For example, your parents, relatives, friends, and brothers and sisters are people who might be important to you. In this questionnaire, we ask about your relationships with these people.

A. Circle all the parents you have who are living:

mother father step-mother step-father

B. Circle the parents you live with right now:

mother father step-mother step-father

C. Please list the first name and last initial of your best friend who is the SAME sex as you. This should be a person that you see regularly. It should not be a friend who you seldom spend time with (such as someone who lives far/away).

a. _____
(first name) (last initial)

b. How long have you been friends? _____ years _____ months

c. Do you go to the same school? _____ yes _____ no

E. The next questions ask about your relationships with each of the following people: (1) your mother or step-mother (if you have both, describe your relationship with the one you live with); 2) your father or step-father (if you have both, describe your relationship with the one you live with); 3) your same-sex friend; and 4) your opposite-sex friend; Answer each of the following questions for each person. Sometimes the answers for different people may be the same; sometimes they may be different.

1. How much free time do you spend with this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

2. How much do you and this person get upset with or mad at each other?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

3. How much does this person teach you how to do things that you don't know?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

4. How satisfied are you with your relationship with this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

5. How much do you and this person get on each other's nerves?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

6. How much do you tell this person everything?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

7. How much do you help this person with things she/he can't do by her/himself?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

8. How much does this person like or love you?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

9. How much does this person punish you?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

10. How much does this person treat you like you're admired and respected?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

11. Who tells the other person what to do more often, you or this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

12. How sure are you that this relationship will last no matter what?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

13. How much do you play around and have fun with this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

14. How much do you and this person disagree and quarrel?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

15. How much does this person help you figure out or fix things?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

16. How happy are you with the way things are between you and this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

17. How much do you and this person get annoyed with each other's behavior?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

18. How much do you share your secrets and private feelings with this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

19. How much do you protect and look out for this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

20. How much does this person really care about you?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

21. How much does this person discipline you for disobeying him/her?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

22. How much does this person treat you like you're good at many things?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

23. Between you and this person, who tends to be the BOSS in this relationship?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

24. How sure are you that your relationship will last in spite of fights?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

25. How often do you go places and do enjoyable things with this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

26. How much do you and this person argue with each other?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

27. How often does this person help you when you need to get something done?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

28. How good is your relationship with this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

29. How much do you and this person hassle or nag one another?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

30. How much do you talk to this person about things that you don't want others to know?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

31. How much do you take care of this person?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

32. How much does this person have a strong feeling of affection (love or liking) toward you?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

33. How much does this person scold you for doing something you're not supposed to do?

	Little or none	Some- what	Very much	Extremely much	The Most
Mother	1	2	3	4	5
Father	1	2	3	4	5
Same-Sex Friend	1	2	3	4	5

Appendix G: SOCIAL PROBLEM SOLVING CODING INSTRUCTIONS

Dyadic social problem exchanges include an *initiator* and *target*. The *initiator* starts a coding event by indicating some goal they wish to achieve. The *target* refers to the other social partner in the dyad. Two criteria are outlined prior to coding any dyadic interaction: 1) the initiator socially engages their friend, the target, as it relates to the task; 2) this initiation must be verbal in nature. Coding on-task behavior is organized into three separate categories: goals, strategies, and outcomes.

Social Problem Solving Goals (all mutually exclusive)

Information seeking – an attempt is made to obtain information for help

Object acquisition – an attempt is made to acquire an object from the target

Stopping an action – an attempt is made to stop or prevent an action

Modifying an action – an attempt is made to change the target's behavior

Attention seeking – an attempt is made to draw the target's attention to a specific object (i.e. the origami or knot tying instructions)

Redirection – an attempt is made to redirect the target back to the task

Social Problem Solving Strategies (all mutually exclusive except for orienting, grabs, and aggressive)

Command – direct imperative (i.e. “move that over”, “give me that”)

Indirect request – indirect statement (i.e. “maybe fold that side over first”, “I think the three loops go on top of one another”)

Didactic – verbal comments outlining instructions (i.e. “now these two folds go down”, “take the

top edges, fold them together, then turn over the paper”, “make a loop on your side”,

“pull this end through the middle”)

Question – (i.e. “where does this end of the rope go?” “what does collapse along the lines

mean?”, “now what?”)

Explanation of consequences – attempt to future orient a current behavior (i.e. “if you do that

there will be an extra knot”, “fold this down too, it is the second sail”)

Aggressive – forceful act directed at the target (i.e. crumpling up the origami paper, shouting at

the target)

Orienting – includes gestures such as pointing

Grab – non forceful or non aggressive grab for an object

Social Problem Solving Outcomes (all mutually exclusive)

Successful – target complies within 5 seconds. Target successes can be non verbal.

Partial success:

Request for clarification – target replies, but for clarification purposes (i.e. “what?”)

Acknowledgement – target acknowledges the initiator but fails to perform the solicited

action

Partial compliance – target complies with only part of the initial action, such as with

negotiation

Failure – target either offers no response or refuses the initiator

Codes following *failures only*

Rigid – the follow-up strategy is exactly the same as the first

Modified – the original strategy is modified

Self solution – initiator addresses their first request on their own

Clarification – the initiator further clarifies their initial response

No attempt – the initiator makes no further attempts

Appendix H: SOCIAL PROBLEM SOLVING CODING EXAMPLES

Origami example

Child A: I think you should be folding the black side down

Child B: Oh...so this goes over here

Child B folds paper so black side is down

Goal: Modify behavior **Strategy:** Indirect request **Outcome:** Success

Child B: Now what?

Child A: Fold the other two ends so they meet in the middle

Goal: Information seeking **Strategy:** Question **Outcome:** Success

Child A: Next - wait, give it to me

Child B continues to work with no response to the request

Child A: Give it to me I figured out how to get the beak the right way

Goal: Object Acquisition **Strategy:** Command **Outcome:** Failure **Follow-Up:**

Clarification

Knot tying example:

Child A: You need to pull your loop through the other two

Child B: How?

Goal: Modify behavior **Strategy:** Didactic **Outcome:** Partial Success – Request for clarification

Child A: No, no, no, stop you're doing it wrong!

Child B: Ok, ok *stops action*

Goal: Stopping an Action **Strategy:** Command **Outcome:** Success

Child A: Ok, now you pull your end and I'll pull mine and we'll have the bunny ear loops

Child B: *pulls their end of the rope*

Goal: Modifying an Action **Strategy:** Explanation of Consequences **Outcome:** Success

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